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Plate II. *Photo by H. F. Macmillan.*

ORNAMENTAL GROUPING OF PLANTS AT THE ROYAL BOTANIC GARDENS, PERADENIYA.

1. Chrysalidocarpus lutescens (Palm).
2. Heliconia rubra.
3. Arundo donax variegata.
4. Canna Pluto.

THE
TROPICAL AGRICULTURIST
AND
MAGAZINE OF THE
CEYLON AGRICULTURAL SOCIETY.

VOL. XXVI. COLOMBO, FEBRUARY 15TH, 1906. No. 1.

The Past, Present and Future of the Ceylon Agricultural Society.

THE PRESIDENT'S ADDRESS.

GENTLEMEN,—At the close of the first year of the working of the Society it is well to consider our position, and to see how far we have progressed towards the attainment of the purposes for which we have associated ourselves. The purposes for which the Society was formed are clearly defined. They are:—

Firstly, to create a public opinion amongst the mass of the native population that improvement of agricultural methods is desirable.

Secondly, to show how such improvement can be effected.

Thirdly, to assist every class interested in land by placing at their disposal the latest and best information on the subjects in which they are severally interested.

Fourthly, to procure seeds of the best varieties of crops now grown and to introduce and experiment upon new products.

Fifthly, to improve the breed of native cattle and thus increase the wealth of the population.

Sixthly, to introduce as soon as public interest is sufficiently awakened a system of co-operative credit banks, and to save the peasant cultivators from the burden of extravagant interest paid for short loans advanced by money-lenders against the growing crops.

My right to congratulate you on the result of our first proposal will not be disputed when I tell you that the

MEMBERSHIP OF THE SOCIETY

has increased from 40 at the end of 1904, just after the first meeting, to 944, and applications are being daily received that bring the number practically up to 1,000 Besides the membership of the Parent Society there are now 41 local Societies formed and affiliated with the Parent Society. Of these 41 local Societies, 16 have not sent in the lists of their members, but the total number on the books of the 25, who have reported, is 1,373; so we may fairly assume the total local membership

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as 2,000. We have, therefore, 3,000 active centres of interest distributed over the island—a leaven of progressive instinct from whose beneficent action I entertain the most hopeful expectations.

But having so far succeeded in arousing this interest, what have we done to satisfy the awakened demand for information? We have acquired "The Tropical Agriculturist," probably the best known agricultural magazine in the East; and, having recast it, have started it as "The Tropical Agriculturist and Magazine of the Ceylon Agricultural Society" under the Editorship of the Director of the Botanic Department who, with every member of his staff, has given the most whole-hearted assistance to the Society—a remark that applies with equal justice to the Director of Public Instruction, the Government Agents, the Colonial Veterinary Surgeon, and every other official whose position gives him an opportunity of influencing the people and forwarding the movement. Besides the five Experimental Stations worked by the Botanic Department, 38 of the local Societies are trying experiments, and over 50 individuals have also formed Experimental Stations under advice from the Society, while the number of school gardens in which elementary agricultural and floricultural instruction is given to the rising generation, is steadily increasing under the supervision of the Superintendent of School Gardens and his assistants.

The Society has also drawn up rules for the conduct of agricultural shows, of which eight have already been fixed for this year under our auspices, and arrangements have been made for the sale of exhibits, if desired, by the exhibitors. I regard these shows as most valuable means of instruction by exciting emulation, so that pride may be taken in the best cultivation, the best cattle, the best home preparation of native products, &c. To bring the information offered to the people within their reach, editions of the journal of the Society are being issued in Sinhalese and Tamil, and the catalogues of the shows will also be printed in the vernacular. In addition to this, any information of immediate importance is printed in the vernacular, and hundreds of leaflets are sent to the local branches. The monthly Progress Reports have kept you informed of the details of the work of the Society in obtaining fresh seeds and arranging for their distribution and exchange, and the 14th Progress Report now before you shows how active is the work of the Society in every branch of agricultural experiment. We have shown that cotton grows well so far as the first crop is concerned, and while no scientific man will give an opinion based on only one year's experiment, we may hope that capitalists will realise that there are many thousands of acres in Ceylon of equal promise as the area of experimental cultivation.

The first step has been taken in sericulture, and the houses and feeding trays are all ready at Peradeniya for an experiment on a commercial scale when the plants are sufficiently grown to supply food for the silkworms. The difficulty in the way of all attempts to introduce new cultivation is that of finding a market for the products, especially where the quantity is small. Well, gentlemen, we have met this difficulty by undertaking to purchase at market rates all such products, and we have arranged with gentlemen in Colombo for their disposal until such time as the production reaches such a volume as will justify merchants in making contracts for delivery in Europe.

The Progress Report will show you how successful the Colonial Veterinary Surgeon has been in his efforts to improve the breed of cattle by the elimination of inferior bulls. Under his instructions over 1,500 of these mischievous bulls have been rendered innocuous, and local Societies are now becoming alive to the benefits of his method, which reduces to a minimum the losses experienced by the primitive and hazardous practice heretofore adopted.

I may add that the gentlemen interested in Poultry Breeding are doing excellent work. This branch of live stock work has already been ably supervised by the Ceylon Poultry Club, which publishes an excellent magazine.

I now come to the last proposal in our original scheme. I see by the Progress Report that it is proposed by three of the local Societies to start credit societies in their districts, and I observe that Mr. Wickremaratna is to-day reading a paper in which this subject is dealt with. I shall reserve any observations for the discussion on the paper. Mr. Wickremaratna is one of our most active and useful members, and anything that he has to say will be listened to with much interest. I will now only remark that no more useful step in advance is possible than the formation of such co-operative Societies, provided that they are formed on a sound business basis.

I will now, gentlemen, approach two important questions that I propose to lay before you to-day. I have mentioned the valuable assistance voluntarily rendered by the Director of the Botanic Department and others. The time has come when it is necessary to increase our staff. I am not in favour of the creation at present of an agricultural department as a regular branch of the Government Service, for the creation of such a Department would inevitably destroy the control of this Board, and ultimately deaden the active co-operation of the local branches. But I desire to secure for the Society the continued services of Dr. Willis and the Peradeniya staff. Dr. Willis has been editing "The Tropical Agriculturist" and no one knows more intimately than the Hon. Mr. Ferguson who is present to-day, what heavy labour that entails. I propose that in addition to his present duties, Dr. Willis shall take over not only the Editor's work but the general supervison of the Botanical work of the Society, and that he shall receive from this Board an honorarium to be settled by the Finance Committee. I hope you will agree with me that the labourer is worthy of his hire.

Now and again I have heard it stated that the Society is not sufficiently active, and that nothing has come of our efforts. I venture to think that the complaint is not well founded. We have been ploughing the furrow and sowing the seed. The harvest is not yet, and what that harvest will be depends upon the soil over which the seed has been cast. But if the crop is to grow it must be tended with the husbandry of instruction, and watered with the waters of example. To do this we must engage at least three instructors, of whom two will be Sinhalese and one Tamil, who will undertake the active supervision of experimental plots, and who will by lectures and personal advice assist in accelerating the movement for improvement. I suggest that names should be submitted by the parent and branch Societies from which the Instructors can be selected. They would go to Peradeniya for a six months' course, and pursue their work of instruction for a time under the personal supervision of an experienced member of the Botanic Staff.

Again, the time has come when something should be done for the important tobacco industry, and I propose that an experienced tobacco-grower and curer shall be engaged, who will not alone grow a crop from selected seed, but who will be available for visits of instruction to those engaged in the cultivation in the Central and Northern Provinces. I am aware that ventures in tobacco-growing for the European market have been tried before and failed. To my mind that is not sufficient reason why we shall not try again. Tobacco grows here, and grows well. We desire to improve its quality with the botanical and chemical talent now at our disposal. I cannot admit that this desire is unattainable, and I submit that we shall not be doing our duty by the large number of tobacco growers in the North and Central Provinces if we decline to experiment in their behalf. There is at present

in the island a gentleman who has seven years' experience as a tobacco cultivator in Sumatra, and I propose to utilise his services. In this matter we are in the same position as was Jamaica, where tobacco grows freely, but the quality was not equal to that of Cuba. However, the Botanic Department was not to be beaten, and I learned from a letter written by the Director of Botanic Gardens that at last they had produced tobacco worth 6*s*. to 7*s*. per lb. in the market. We must do the same. At least if we cannot command success, let us do more: deserve it.

I must apologise for the length of my statement, but I cannot conclude without expressing my warmest acknowledgement to our able and energetic Secretary, Mr. Denham, who has worked so unremittingly in the interests of the Society since its formation, and to the many gentlemen who have read valuable papers at our monthly Board meetings are due the grateful thanks of the Society.

While the Government is ready and willing to assist us by every means in its power, it must not be forgotten that the Ceylon Agricultural Society is a non-official body dependent for success upon the confidence and co-operation of the people. May that confidence continue and co-operation produce in the future a steady increase in the comfort, the happiness, and prosperity of the people of Ceylon.

Experiment Stations.

As there seems to be considerable misconception going at the present time as to the aims and objects of an Experiment Station, it may be useful to give a slight outline of what is aimed at in such an institution. Ceylon practically led the way in the establishment of large Experiment Stations; many of the West Indian and other colonies, besides Java and other places, possessed such places, but they were all on the very small scale, growing one-tenth of an acre with this manure, one-tenth with that, growing one-quarter of an acre with this crop, one-half with that, and it was Ceylon which really set the example, now being universally followed, of having large Stations, upon which the various crops should be grown on large areas, so that enough yield should be obtained to be dealt with in the same way as it would be upon an estate, and enough to be worth selling in the open market, instead of getting a valuation of a small sample through Kew or the Imperial Institute, or in other ways.

The Experiment Station represents an outgrowth of the older organisation of "Botanic Gardens," which were kept up in most of the first-class Colonies, and brings them into line with the more modern conditions, to which the older organisation is no longer suited in any way. Until about the year 1880 (in Ceylon) or 1885, the main duty of the Botanic Gardens was the introduction of new plants into Ceylon, which were likely to prove useful in agriculture or in horticulture, but since that period the work has gradually decreased in importance as practically all the useful plants that would grow in the island were one by one introduced, and as the organisation of private agencies for the supply of seeds and plants more and more narrowed the sphere of operation of a public agency for the same purpose. During the period from 1880 to 1890 almost the only useful plants that were actually introduced by the Botanic Gardens were the Milk tree, the Fustic, the Eagle wood, Cinnamomum Cassia, Jacaranda mimosæfolia, the Tree Tomato, species of Willughbeia and Landolphia, the Benzoin, the Balata, Millettia, the Maté, Cedrela odorata, and the Kei apple, none of which can be said to be of any serious importance in Ceylon, or likely to become of such. The duties of the Botanic Gardens were in fact reduced to pushing the plants already introduced, like cinchona, cacao, and rubber. These products being once properly taken up, it is evident that the older organisation must either expand in new directions, or become moribund, attending mainly to horticulture (we leave out of consideration in this place the very important duty of working out the native flora of the colony, because this has now been very largely done for Ceylon, though not for such colonies as the Straits).

The salient feature of the past century in Ceylon was the occurrence of a series of "booms" in the cultivation of the different economic products formerly only cultivated by the native races of tropical mankind, or only collected from wild plants in the jungle. One by one, coffee, cinchona, tea, cacao, cardamoms, and indiarubber, have risen into prominence. The history of the present century will almost certainly be very different, seeing that now practically all the tropical products of any importance whatever are being cultivated by Europeans or Americans somewhere or another, with all the resources of capital, science, and politics.

Acclimatisation, then, has seen its best days here, and it is now of much greater importance to attend to our existing industries, and preserve and extend them, than to devote all our attention to the comparatively minor chance of replacing them when they fail. It is to meet this new phase of the economic position that the constitution of the Royal Botanic Gardens has been largely changed during the past ten years, and that to the old organisation of Botanic Gardens for the introduction—

and trial on a very small scale—of products likely to be useful, there have been added Experiment Stations for the study of methods of cultivation and preparation of products already grown in the island, upon a commercial scale, as well as for the trial of "new products" which may yet become of value in Ceylon agriculture. Such experiments are better suited to a properly equipped scientific institution, which is not obliged to show a profit, than to private individuals, especially as such work is becoming daily more technical, and agriculture more scientific.

The Experiment Station then, deals with such questions as "what is the best manure for cacao on the soil there existing?" "what is the best way of cultivating lemongrass?" "what is the cheapest way of curing cacao to get the best price?" "what is the best shade tree to use among tea?" and so on. The usual way of tackling such a question is to have two plots, of whatever size may be sufficient to give results that are fairly reliable, one without any treatment, the other with the treatment that is the subject of experiment, and to compare the result of these two plots over a series of years. Should the plot treated in the new way always show a smaller return than the untreated one, it is fairly evident that that method of treatment is a failure, if the reverse, that it is a success.

It is no part of the ordinary duty of an Experiment Station to show *model* plots—the important thing is the comparison between the plot treated in a particular way, and the plot untreated. Naturally the plot will be kept in as good condition as possible, but visitors must clearly understand that the Experiment Station is not necessarily a place where they come to learn the very finest way of laying out and cultivating their crops. Nor must they expect results in a very short period; it often takes several years to obtain a result of any definite value. Nor again, should they regard everything that is going on as a subject for imitation, unless they realise that it is experimental; many, if not most of the experiments, will probably be failures, and in any case, the results will require modification to suit the particular circumstances of the new place.

The results of the experiments have to be carefully worked out, and are then published by the institution, and people who try the experiments going on upon the Experiment Station for themselves must realise that they are trying experiments, and when they fail, as they perhaps most often must fail, should not blame the institution, which cannot and will not take responsibility for unpublished work. As an illustration of this, take the experiments now going on at Henaratgoda upon tapping rubber trees above six feet from the ground. These are old trees and the process is as yet simply an experiment, yet people have seen it going on, have gone off and tapped *young* trees in the same way, and now blame the Department for their failures.

GUMS, RESINS, SAPS AND EXUDATIONS.

The World's Rubber.

A MEXICAN CASTILLOA RUBBER PLANTATION.

We have already referred to the fine La Zacualpa rubber plantation in Mexico, of the Hidalgo Plantations Co., and now we have received further particulars about it in an interesting pamphlet entitled "Rubber: what it is and how it grows," by the general manager of the company. This is the second edition of the pamphlet (which is illustrated from photographs), and in his foreword the author says, "Since the first edition was issued, rubber has advanced in price, with every prospect of its going higher, and the attention of the business world is more than ever turned to this profitable industry. This book is dedicated to the young people of our public and private schools, with the hope that the matter it contains will be found interesting as well as instructive."

The first part deals with rubber generally, but here we only quote some particulars about La Zacualpa estate, which show how a big rubber estate in Mexico is run and give information of use to planters of *Castilloa elastica* in Ceylon, India, Assam, &c.:—

LA ZACUALPA RUBBER PLANTATION.

La Zacualpa rubber plantation is, without doubt, the foremost of its kind in Mexico, and for depth of soil, requisite rainfall, systematic drainage and intelligent management has not its equal in the world. It is situated between the towns of Huistla and Escuintla, about 20 miles from the Pacific Ocean, and near the Pan-American railroad which is to connect Tapachula with the Tehuantepec railroad at San Geronimo. This road has already reached Tonala, and will be pushed through to completion under a most favourable concession from the Mexican Government. The planted trees are easily accessible at all points by avenues running for miles; seven of these have already been named, as follows: Harrison avenue, Van Court avenue, Alicia avenue, Butler avenue, San Carlos avenue, La Reina avenue, Santa Helena avenue. These are crossed by streets that are numbered, and the visitor can ride for miles through groves of healthy rubber trees, the branches of the older trees arching overhead. At the present writing some 8,000 acres are planted.

CASTILLA LACTIFLUA.—In a letter received from Mr. O. F. Cook of the Agricultural Department, Washington, he says:—"You will doubtless be interested to know that I have recently described the Soconusco rubber tree as a distinct species, under the name, *Castilla lactiflua*. The Castilla of the Soconusco District of the State of Chiapas ("C. Lactiflua"), is peculiar in having the complemental inflorescence flattened and with a broad mouth; it is very similar to the primary, except in the smaller size. The specific name alludes to the fact that the milk of the tree flows freely when the bark is cut, so that it can be collected in quantity and coagulated by improved (creaming) methods, instead of the rubber being harvested wholly or partly by pulling the 'scrap' (*burucha*) from the gashes in which it has dried."

The Department (or County) of Soconusco, in the State of Chiapas, one of the twenty-seven States forming the Republic of Mexico, is the natural home of the *Castilloa elastica*, or Mexican rubber tree, as proven by the great number of wild rubber trees which grow spontaneously in its forests. In their wild state they grow tall and lank, reaching a height of over fifty feet and a diameter of twelve to eighteen inches.

As far as known the trees are long-lived, and increase their output of latex yearly until as many as twenty-five pounds of crude rubber have been taken from a single tree. It is only within a few years that attention has been called to the cultivation of this tree. During the years 1889 and 1890 a grove of some 5,000 of these trees was planted on La Zacualpa, a plantation in the above Department, which trees are now (1905), on an average, eighteen inches in diameter and forty feet in height, and are yielding about two and one-half pounds of rubber to the tree. They stand about 400 to the acre and are in prime condition. These are the trees referred to by Mr. O. F. Cook, Bulletin 49, issued by the United States Department of Agriculture, as follows :—"The planted trees at La Zacualpa abundantly demonstrate the practicability of rubber culture."

The successful production of rubber and growth of these trees, combined with their present healthy state, has proved the fact that *Castilloa elastica* can be easily cultivated in its native habitat, with large profits. Cultivated trees are raised from the seed, and begin to yield milk during the sixth year from date of planting.

The trees have no natural enemies, as, by reason of the quantity of resin and albuminoids contained in the milk, they are not molested by worms, insects, birds or animals.

Owing to the successful conditions noted above this plantation has been extensively developed, and under the care of expert rubber cultivators about 3,000,000 rubber trees are growing vigorously. The cultivation of rubber is a new enterprise, calling for the most careful study, and is a notable addition to the world's varied industries. Consequently, the questions of soil, rainfall and climatic conditions must enter largely into the calculations of those contemplating its future. The rubber tree requires a rich loam soil ; warm, moist climate ; low altitude ; a large and evenly distributed rainfall, and perfect drainage. All these conditions exist in the Department of Soconusco. The rain record, taken daily by the British Vice-Consul, R. O. Stevenson, has averaged 160 inches for many years past. The plantation consists of 18,791 acres of land, of which 12,000 acres have been set apart as La Zacualpa Rubber Plantation and are now being planted with rubber trees.

Labour.—The management is entrusted to one superintendent, two majordomos, or sub-managers, and one corporal to every thirty men. During the planting season about 300 men are employed, with ten corporals. All the planting s done under the supervision of rodmen who have formerly worked with engineers, and the lines outlining the planted squares and avenues between are run with great care. At sunrise the plantation bell calls the labourers to work, all assembling in the patio, or yard, in front of the manager's house. The majordomos receive their instructions from the manager and communicate them to the corporals, who in turn direct their men, regarding the work of the day; and are responsible for the performance of their respective duties. The bell, which can be heard in all parts of the plantation, announces the noon hour, and at 1 o'clock work is resumed, continuing until sunset. Everything is done in the most systematic manner, and the plantation is kept clean and in good order at all times. The supplies needed are furnished from the company's store, and a large bake oven is provided for the use of the labourers. Generally four or five women do all the baking, and sell bread to those wishing to buy.

The location of the plantation is an ideal one, level for the most part, but sufficiently rolling for good drainage, well watered, entirely free from stones and gravel, and has the reputation all through that country of being a very

choice strip of rubber land, The elevation at no point exceeds 400 feet, and at some places is as low as 100 feet. La Zacualpa Rubber Plantation is a most interesting place, and improvements are constantly being made. A sawmill is in constant use, preparing timber for the construction of permanent houses for the native labourers and other buildings for the company's use. Excellent tiles have been made from clay found on the plantation and are used in roofing buildings. The population of La Zacualpa today, including men, women and children, is over 600. The same plan has been carried out in the buildings for the labourers as that used in the plantation proper, the buildings being situated on plazas, or squares.

THE CASTILLOA ELASTICA TREE.

The *Castilloa elastica*, or Mexican rubber tree, is between five and six years old when it blooms. Before blooming the tree sheds its leaves. The blossoming season begins in January and continues until April. Clusters of small, whitish blossoms first put forth, and three weeks later the tiny petals fall, leaving a little green centre which gradually enlarges, and is filled with seed points sticking fast to a round disc. The blossoms are as numerous as the leaves, and each one has at least twenty seeds about the size of an ordinary bean. When the blooming and seeding time is over the trees put forth new leaves.

The seeds are encased in a shell which is hard while green, but it soon softens into a sticky substance like fish gelatine. The first turning in the ripening process is to a sickly yellow, which gradually changes to a bright red. As soon as the seeds are ripe, with the first rains they begin to fall. This is a busy time on the plantation. The seeds literally cover the ground underneath the trees, and the labourers gather them into sacks and carry them to the nurseries. There they are dumped into pails filled with water and washed thoroughly to detach them from the discs and rid them of the enveloping gelatine substance. When the seeds have been ripe sixty days they will no longer germinate, and to get the best results should be planted immediately after washing, which is done to facilitate handling and prevent them germinating in the gelatine coating.

PLANTING.—There is some difference of opinion among planters as to the best methods of planting, some advocating partial shade, and again some would plant from a nursery previously formed, and others with the seed at stake. Difference of local and climatic conditions is no doubt the cause of this diversity of opinion, as each section calls for different methods. The method adopted on La Zacualpa and that which has been productive of the best results in that locality is the following .—

The land is first surveyed into squares of thirty-three acres each, which includes avenues and roads twenty-four feet wide between them. The roads run in straight lines and are cleared of all trees and shrubs, thus making them avilable for the use of the workmen and inspection of the plantation. The roads running north and south are called avenues, and those east and west streets, the former being named and the latter being numbered. The roads are now several miles long, and in order to facilitate transportation of the labour to various parts of the plantation, the Company is about to put in a small electric railroad. The land is cleared by cutting down the forest and is then burnt off. Some of the largest trees are left, and most of them escape the fire and send out new foliage, which then acts as partial shade to the young trees. After burning the land is then staked out to allow for 400 trees to the acre. A small mound of earth is made at each stake, and the rubber seeds are imbedded therein.

The seed will germinate in from eight to fifteen days, and one month from the time of planting the plant attains a height of about eight inches, and its growth from this time on is rapid and may roughly be put down as one foot per month. Our three-year-old trees are over thirty feet high, and those of four years about

thirty-five feet. After the planting has been done, great care is taken that the forest growth does not choke out the young tree. This growth is kept down continually, thus giving the young rubber tree a good start until it is able to take care of itself, which it can do two years after planting, after which time it requires very little attention.

TAPPING METHODS.—The native Indian method of tapping is as follows:—Before beginning to tap a place is selected on the tree, preferably on the inclined side, and a hole made in the ground below, lined with a wide green leaf. The tapper makes two incisions with his machete at right angles, coming together in the centre. This is done to ascertain where the milk runs best. Once decided, the tapper makes a narrow incision at the point of convergence and improvises a funnel of the same leaf used in lining the hole in the ground. This acts as a conduit for the milk, which runs from the tree in a steady steam into the hole until it coagulates along the line of incision, when, if desired, it is scraped off twice or more before the stream finally ceases. Very often the milk spurts out, and one could not stand close to the tree where the machete is at work without getting one's clothes spoiled. The rubber coagulates where it falls on the clothes, and will not wash out; only a solvent will remove it.

The bark of the tree is not only cut once, but at least four or five times, at intervals of two feet. The next year the angles cross each other, giving the tree a peculiar criss-cross appearance. Once the milk is flowing freely, the tapper leaves the tree and goes to another, repeating the process already described. By the above method a dozen trees are considered an average day's work. When the milk ceases to flow the tapper returns and carefully picks up the leaf in the hole and pours its contents into a large gourd. This is naturally a crude and wasteful process. An unskilled tapper either gets all the milk on his own clothes or else it runs round the tree and is lost. It is usual to begin tapping in May and continue until December inclusive.

The latex, or milky juice of the bark of the rubber tree, is quite distinct from the sap which circulates through the wood, and contains from 32 to 44 per cent of gum. Pure rubber milk is white when it first runs from the tree, closely resembles that of the cow; but in the drying process it gradually oxidizes and turns black.

COAGULATING—NATIVE INDIAN METHOD.—When the milk is brought in from the forest it is thinly spread on the long, palm-shaped leaves of the *oja blanca,* which have first been laid on the ground in the hot sun. Toward the stem, where the milk lies thickest, it is necessary to stir it while drying; otherwise it would coat over thickly on the outside and be full of the residue fluid, bringing a less price in consequence. When the leaves are coated evenly, a quarter-of-an-inch thick, they are piled one above another and pressed hard enough to cause the rubber strips to adhere closely. Then, by a dexterous movement, the tough leaves are pulled off and the thin layers are rolled into slabs ready for packing.

CLEANSING THE RUBBER.—The slabs of dried rubber are packed in bales of 150 pounds each, covered with the native-made matting, sewed up in sacks, shipped per steamer to various countries and sold to the rubber manufacturers. The first process in the manufacture of crude rubber—necessary on account of its being prepared by the native method—is to pass the slabs through large corrugated steel rollers, water falling from a reservoir upon the rubber as it passes through. This is repeated a number of times until all the dirt and foreign matter is eliminated, and the rubber rolled into thin perforated sheets having a rough surface. These sheets are from eight to twelve feet long, and eighteen inches wide. They are then hung in the dry room, where they remain until all the moisture has evaporated. The rubber is then ready for the next process.

Washing the Rubber.—By the methods now adopted the foreign matters are washed out of the latex before coagulation takes place, thus producing a very high grade of rubber from the castilloa, having a marketable value equal to that of Para. Until now it was generally assumed that the Central American Rubber was of much inferior grade to that of Para. It has now been proved, however, that the actual difference is very slight, if there is any, and resolves itself into the question of preparing it for the market at the time of tapping. During the past few months the best qualities of some rubber from cultivated castilloa trees brought $1.51 and $1.56 gold per pound on the London market. This price was higher than that of best South American Para sold at the same time. Mexican rubber from wild castilloa trees and shipped in the old way already referred to was quoted at 60 and 65 cents per pound, or less than one-half the price obtained for the same rubber prepared according to modern methods. As it is necessary to treat the latex as soon as possible after it is collected from the tree, receiving stations should be established on a large plantation, such as La Zacualpa, so as to avoid the transporation of the latex to any great distance.—*Ceylon Observer.*

RUBBER IN SOUTHERN INDIA.

A planting correspondent of the *Madras Mail* refers as follows to the rubber planting industry in Southern India :—

Ficus elastica is certainly not a tree to plant amongst coffee or near anything valuable, if one may judge from the Peradeniya trees. These completely occupy a large area with their roots, and are now showing signs of decay. As, however, I understand they are getting on for 50 years old, there would be time to extract a fortune out of them if they contained it; some quicker-yielding trees, however, are preferable. Kicksia trees grow well in S. India at 3,000 feet or so; at Peradeniya it is found that they are so eaten by caterpillars that nothing can be done with them.

Vines and root rubbers need not be considered by those who can grow a tree and, in considering which is the best to select of the above, I would certainly give the award, as a general thing, to Para. It is, as far as I have seen, decidedly the hardiest of all. Growing well at sea level, it maintains a good, paying growth, to at any rate between 3,000 and 4,000 feet, and looks well and healthy at 4,700 feet It resists ill-treatment wonderfully, and is practically unaffected, as far as I can see, by excess of rain or severe drought; whilst it is a useful shade for coffee for a good term of years. Our ideas as to the height at which it can be profitably grown have steadily enlarged. In South India I have given measurements of growth at 3,500 feet; and I may mention that I have plants 6 feet high from seed planted at stake, amongst coffee, in 1904. Mr. R. Wickham, when on "the upper tributaries of the Amazon, in the natural habitat of the Hevea," saw trees growing at "certainly over 4,000 feet;" and all he saw being tapped were over 2,000 feet above the sea. The general opinion, however, was that it does not pay to tap trees at over 3,000 feet. This was between 12° and 14° south. The above is important, confirming as it does what I have previously stated as to the profitable growth of Para at an elevation of several thousand feet. And, taking the opinion that "it does not pay to tap trees at over 3,000 feet," what does this mean? We must remember the nature of the forest tapping, where trees are scattered and where, we are told, trees of 2 feet girth would not be noticed as worth tapping, and only the widely scattered giants, giving 5 lbs. or more rubber, are selected. At over 3,000 feet these giants would be comparatively rare and take much finding, but plantation conditions would make

all the difference. At 3,500 feet the trees on a plantation would be at just the same distance apart as at 1,000 feet or 2,000 feet. They would perhaps require another year to make equal growth, but this would not prevent their paying handsomely

Too much attention cannot be drawn to the concluding remark in the Curator's last report on the Government Botanical Gardens. "Experimental work has, however, to be conducted on a comparatively small scale, owing to the undermanned staff, but, if a few much needed additional competent men were employed, the experimental work now carried on in this department could be placed on a better basis and steadily developed." This is quite true. An institution which might be of most valuable assistance to planters and agriculturists is practically of little use because of the ill-judged economy shown by Government. The Gardens at Ootacamund are of little practical use, perhaps I should say commercial use, but the fragments of tropical gardens at Burliar, Kullar, and elsewhere might, if enlarged and under "competent men," be, in a small way, a source from which a large supply of information, seeds, plants, etc., might be drawn.

CEYLON RUBBER AND THE MANUFACTURERS.

Some interesting views of British manufacturers on Eastern plantation rubber are given in the "India Rubber World" (December 1st). In an introductory note the Editor says: "The Plantation product is so much cleaner as to justify Mr. Burgess, perhaps, in asserting that the prices are really in favour of the Brazilian rubber, pound per pound of real rubber. That the new rubber possesses intrinsic value is nowhere doubted ; just how it will compare ultimately with other rubbers that have longer been in use, however, and for what purposes manu facturers will prefer the new rubber, remain to be more fully tested in practice.'

THE SOLUTION MANUFACTURERS.

The Managing Director of one of the first rubber factories in Great Britain to experiment with Ceylon rubber, says,

"We have only as yet used plantation rubber experimentally and sparingly. Until it arrives in greater quantities it is too dear for the general trade since the solution makers *cannot afford* to pay two pence a pound more for it than ordinary mechanical manufacturers. When it arrives in excess of the solution requirements, the prices will rectify themselves.

"We don't make solution for the trade, but merely for our own requirements. The quantity from any one estate is yet too trivial to be worth much attention, and as yet the London auction sales offer the best choice for the buyer and best price for the seller.

"The qualities vary even from the same estate, according to the age of the trees, whilst yet so young. We judge that the rubber has not attained its full strength till the tree is at least 8 or 9 years old; younger than that, though good gum, it has not the strength of hard cure Madeira fine Para, and is uneven in strength. There is no difference noticeable in the rubber from 8-year-old trees from different plantations. We have used about 4 to 5 tons in testing it, from about 20 plantations. As yet it is not safe to use for the finest work, such as India-rubber thread and the best bladders, but where a 'weak Para' will do, it is all right."

CEYLON *versus* BRAZILIAN.

A member of the British rubber trade, though not at present a manufacturer, o whom the preceding lines were shown, offers this suggestion :—

"It is true that an absolutely fair test of plantation rubber in comparison with Brazilian Para rubber has not yet been possible, owing to the fact that the

Ceylon and Straits products so far have been marketed in such small lots—though the aggregate may have been important—and varying so in quality and condition that the manufacturer seeking to use these sorts has been unable to obtain either an important quantity at one time or an assured supply of a given quality for regular consumption. These things will right themselves, however, with the increasing production of the plantations and the better care in the preparation of the rubber. But there is something for the manufacturer to do as well as for the planter, in arriving at the best possible results from the new class of rubbers. For instance, the manufacturer here quoted is of the opinion that the Ceylon rubber is not safe to use in making rubber thread. But the nature of his tests is not indicated. The fact that this rubber has not given good results for thread under the established practice in his factory is by no means conclusive. Possibly with a variation from his practice, for instance in regard to vulcanisation, a thread equally as good as many others in the market might be produced. The whole industry will recall the variations from any former practice which were rendered necessary after the introduction of Africans before satisfactory results were obtained, but now the consumption of Africans has become very large, and for many purposes with as good results as from the best Para sorts. In fact, there are uses for which some of the Africans are preferable to Para rubber."

BISCUITS PREFERRED TO CREPE.

A firm of London rubber brokers writes as follows in regard to plantation rubber from the Far East:—

"At present the quantities have not been sufficiently large to be taken generally by manufacturers, and it has yet to be ascertained for what purposes these new plantation rubbers are most suited, and how results compare with ordinary fine Para. There is no doubt that for some special purposes the pancake and sheet rubber both from Ceylon and the Malay States have been found very suitable, and in very convenient form of preparation, but it will have to come in much larger quantities before it can establish its proper place in competition with fine Para and be generally used by manufacturers who must have regular supplies. Up to now we have found very few consumers to look with favour upon the washed and crêpe rubber, and they nearly all say they prefer the biscuits or sheets, and will do the washing themselves. The crêpe and washed is liable to heat *en route*, which is against it."

RUBBER CULTIVATION ON THE SHEVAROYS.

The Collector of Salem wrote to the Government in April last pointing out that they had granted temporary remission of assessment on lands cultivated with special products in the Nilgiris and the Wynaad, and that this concession had been extended to rubber. He suggested that the concession thus granted to the above-named planting districts might be extended to the Shevaroy Hills in regard to lands newly cultivated with rubber. He made the reference as Mr. A. G. Nicholson intended to start rubber cultivation on the Shevaroy Hills, and suggested that the remission of assessment should, in his opinion, be for a period of five years. After some correspondence on the subject during the last six months, the Board of Revenue recommended to Government that the concessions sanctioned in G. O., No. 604, Revenue, dated 30th June, 1905, might be extended to *all* lands on the Shevaroys *newly cultivated* with special products. The Board further recommended that rubber and Caravonica cotton might be declared to be special products eligible for the above concessions. The Board concurred in the opinion expressed by the Collector of Salem that the concession should not be applicable to the case of a mixed crop, part of which was in bearing.

The Government have passed the following Order on the subject:—The concession given for the cultivation of special products of established economic importance, on lands held by planters on special leases, will be extended to all lands on the Shevaroys, subject to the conditions referred to in paras 2 and 3, G. O. 604, dated the 30th June, 1905. The assessment on land in the Shevaroys newly cultivated with special products will be remitted for three consecutive years from the date of first cultivation with a special product. Rubber and tree cotton (including Caravonica) will be treated as special products eligible for the above concession. The concession will not be applicable in the case of a mixed crop, part of which is in bearing. The Government reserve to themselves the right to alter or cancel these concessions on any abuse of them or for other reasons.—*M. Mail.*

Manufacture and Machinery.

THE PREPARATION OF RUBBER AT MERGUI, TENASSERIM.

The following notes upon the preparation of rubber at the Mergui Plantations in Tenasserim have been kindly forwarded by the Inspector-General of Forests. They are extracts from a letter from the Conservator of Forests (Mr. F. B. Manson), Tenasserim Circle:—

The term "wet process" for the preparation of the rubber is used in contradistinction to the process of curing by hot air and smoke in Mr. Wickham's machine.

2. The wet process in use at Mergui Experimental Gardens is the simplest possible method and yields very clean rubber. The fluid latex strained, but without any admixture of chemicals but diluted with water, if too thick, is set to cream in soup-plates. The rubber particles, which are of lower specific gravity than sap, gum, etc., rise to the surface whilst the watery constituents of the latex and impurities sink. After about 24 hours or less the rubber forms a soft creamy white cake, which is removed by hand, pressed, stamped with the plantation mark, washed and then placed on well-ventilated racks under a shed to dry. I should mention that after the cakes of rubber are removed from the soup-plates the residual liquor, which is usually slightly milky, is collected along with the washings of the collecting cups in larger vessels, some clean water is added, if necessary, and the mixture stirred. After standing for 24 hours or so a certain quantity of rubber rises to the surface. This is carefully washed and dried, and is sold along with the scrap. I contemplate treating this quality of rubber eventually in a washing machine and exporting it in the form of sheet-rubber. Manufacturers, however, seem to be quite content with the "pancake" or biscuit rubber now sent from plantations.

The quantity of latex at present dealt with is inconsiderable, being derived only from the older trees in the Experimental Gardens. It is not sufficient to warrant the purchase of expensive machinery, but I am of opinion that some simple machinery and drying apparatus will be needed in a few years' time as all labour available will be required for collecting the latex. I have accordingly made enquiries through the International Rubber Planters' Association, of which I have become a member, with a view to improving our present primitive methods of preparation and hastening the drying process. As this concerns our methods of preparation, I beg leave to enclose a copy of my letter of enquiries, and to refer you for the sequel to the *India Rubber*

Journal of the following dates:—16th January, correspondence *re* Washing Mills, 13th February, page 169, "A Question for the Rubber Trade," 27th February, page 222, "Washed and Dried Rubber," 13th March, page 269.

It is possible that it may be found profitable to adopt the centrifugal separation of the rubber particles from the latex diluted with water (Biffen's patent) or a modification of it which is announced from Ceylon; but until a considerable number of the plants in the larger plantation are large enough to be tapped, it will, I consider, be sufficient to go on as we are doing. I beg to append extracts from my last inspection notes of the Mergui Plantation relative to the preparation, drying, and packing of the rubber, and the account sales of the last two consignments, from which it will be seen that our rubber fetches excellent prices. The price of Fine Para opened at 5*s.* 1*d.* in 1905, and in the second week of March stood at 5*s.* 5*d.*

(*Extract from Inspection Report on Rubber Plantation at Mergui.*)

THE PREPARATION OF RUBBER.

3. The preparation of the rubber has been vastly improved by the Manager (Mr. J. W. Ryan), but still leaves room for further improvement. For example, the biscuits are of various shapes and sizes, some being very thin and shrivelled up. It is desirable that all should be as nearly as possible alike. Moulds of several kinds have been tried, but they do not give better results than the ordinary soup-plates. Plates of the same size and make should be used, so that the pancakes may be the same. A measure or ladle should be used, for putting an equal quantity of latex in each plate so as to obtain cakes of equal thickness, say eight to the pound.

THE MARKING OF THE PANCAKES OR "BISCUITS"

may be, and to some extent is, done by hand by pressing each cake with one of the plates originally intended to be used in the moulds. This is a slow and expensive method which will be improved upon when the yield increases. The cane hammocks on which the pancakes are hung to dry are allowed to sag too much, so that the cakes of soft rubber become deformed and unsightly If the cane will not bear stretching tight it will be better to use wire-netting, say of two inch mesh, on which the cakes of rubber will lie flat. The pancakes when removed from the plates or moulds are very soft and of a creamy white colour. I noticed that the liquor which moistens them is sticky and gives the cakes a sticky coating apparently of some gum-resin, which is very apt to get mouldy in damp weather. This must be remedied either by diluting the latex before it is poured into the plates or by throwing the pancakes into clean water and washing them when they are taken out of the moulds. It will also be a good plan to subject them afterwards to pressure, so as to squeeze out moisture and imprint the Government mark upon them before putting them on the racks to dry.—*The Indian Forester.*

TO TEST THE ELASTICITY AND RESILIENCE OF RUBBER.

MR. J. B. CARRUTHERS' INVENTION.

An apparatus specially designed by the Director of Agriculture for testing the elasticity and resilience of rubber, constructed by Messrs. Baird and Tatlock from Mr. Carruthers' drawings, is now being experimented with at the laboratory of the Department of Agriculture. The object of such a machine is to subject the piece of rubber to be tested to a measured and exact strain, and one which increases

gradually from nothing to the required amount. In Mr. Carruthers' machine this is achieved by pouring a fine stream of quartz sand into a receiver attached to the rubber being tested. The rubber is first carefully measured between two marks; then the required strain is applied, and a second measurement, shewing the amount of stetching, is taken.

After the strain has been removed, a third reading is taken to shew the recoil of the rubber, which, in the best products, should not be far from the original measurement. The whole apparatus is enclosed in a copper case with a glass door and a water bath below, in order to keep the rubber at a constant temperature, so that comparative tests may be made. The measurements are taken by sliding pointers moved by handles from the outside and running on a scale graduated to millimetres and tenths of an inch. A large number of rubbers will be tested so as to show the relative physical properties of old and new, of rubber chemically pure, and of that containing small proportions of resin.—*Malay Mail.*

Rubber Tapping.

TAPPING RESULTS IN SINGAPORE BOTANIC GARDENS.

Messrs. H. N. Ridley and R. Derry have just compiled their report on the experimental tapping of Para rubber trees in the Botanic Gardens for 1904, which has been delayed for the reason that of all the rubber obtained in that year the sales took place in 1905, and not until 28th October was the result of the last sale received. A sum of $1,200 had been voted by the Legislative Council for this tapping of the rubber trees at the Gardens; 880 were tapped and 884½ lb. of dry rubber was obtained. When sent Home in four lots for sale it realised $2,440. The largest price got was 6/9¼*d.* After reviewing the experiments and commenting upon the relative value of close and open planting, the reporters say in conclusion :—

Much remains to be done in connection with rubber. Improved methods of tapping will naturally evolve. The great problem, however, is to bring the dried rubber produced in the Straits up to the standard of best Para, and the difficulty we suspect is the same as in the case of gambier or copra, and lies in combating the excessive humidity of the country. Washed rubber no doubt is an economical and expeditious method; but we fail to see that any improvement in the texture of the rubber is likely to result in the future over the present by this process, for little could be done in this direction, as unfortunately the market does not assist experimental work and only recognises one class of rubber, and prices are high or low as the rubber compares or approaches the approved class. Now, however, as the Government Analyst will be prepared to test samples, experiments will also be made in different methods of drying.—*Straits Times.*

A REVOLUTION IN THE RUBBER TRADE.

THE DIRECT EXPORT OF LATEX TO EUROPE.

Our technical contemporary, the *India Rubber Journal* (October and November), gives a special translation of a report by the French Dr. Morisse, entitled "La Révolution de l'Industrie du Caoutchouc," the major portion of which we quote here :—

We, ourselves, naturally take no responsibility for the statements made in this lengthy and eloquent pamphlet, contenting ourselves by satisfying the

curiosity of our readers in giving them an opportunity of perusing in English one of the most amazing documents it has been our fortune to read. The writer apparently has never heard of Hancock's investigation in this direction.

The following article does not treat of any artificial or so-called regenerated rubber, but refers to natural rubber of first-class quality, in a word, of Para, but a quality of Para purer than that gathered in the plantations of Ceylon, although this is reputed to contain but 1½ per cent. of impurities.

The new idea, the revolution, resides solely in the method in which this product is prepared; in effect it aims at the almost total suppression of the costly plant that the manufacturing of rubber requires, by reducing it to its most simple expression—and it proposes to do this by starting from an entirely new base, that of the latex itself, in place of its dried extract, alone employed for industrial purposes to-day . . . . The property of a substance, so rebellious to all coercion as gomma elastica or rubber, is precisely to return immediately and incessantly to its primitive form, as soon as an outside power, which has been forcing it into another direction, ceases its action. This is the essential property of rubber, the reason of its existence one might say, and the essence of its being—but this property has its defective side—its irreducibility to all conformation . . . .

Let us go into a rubber works and watch this incredible transformation, this marvellous exhibition of skill which takes place every day. Take the purest of the so-called gums, the cleanest, that which is prepared with infinite care by the Indians of the Amazon and Orinoco basins—the Para. This sort still contains about 10 per cent. of impurities, notwithstanding the precautions taken by the natives, who have, however, necessarily neglected the only reliable one now employed in Ceylon, the filtering of the latex, or milk of the Hevea, which yields the Para. The blocks of Para are sliced up and passed through a washing mill, consisting of two strong horizontal rollers of equal diameter, driven by steam and turning towards each other. The same material may be passed through the rollers twenty, thirty, or forty times, while a plentiful and continual watering washes away the bits of bark, leaves, and dust and other impurities mixed up with the raw rubber. At length in this way a pure rough clean substance is obtained, in form of sheets which are left to dry in free air, during weeks at a time, when the excess of water should be naturally evaporated. Then the sheets are passed on to a mixing machine, where are incorporated other inferior rubbers of different kinds, and to this mass is slowly and gradually added a crowd of ingredients, of which the principal purpose—though generally denied—is to substitute heavy and cheap substances for Para rubber, which at present costs 5*s.* 6*d.* per pound. Thus are added sulphate of lime, oxide of zinc, litharge, wood-powder (lycopodium), and sulphur, which will presently serve for the vulcanization. Of this last product rubber can be made to absorb up to 10 per cent. and even 25 per cent. for vulcanite, and an up-to-date mixing machine may cost £1,600! The cyclopean rollers powerfully and remorselessly mix and knead the resisting crackling mass, and the mixing is carried on for long hours, until at last the compound is thoroughly coherent. It is sufficient to have once assisted at this extraordinary triumph of mind over matter, to notice how tenacious the elastic properties of rubber must be, to be preserved throughout this remarkable treatment. To say that the properties of rubber do not suffer would be nonsense, but at last a sheet of equal thickness has been obtained, from which different parts of the object to be manufactured may be cut out by punches or other methods . . . .

To a thoughtful man no great intellectual effort is required to understand that none of these difficulties would exist if one could directly utilise the vegetable milks or juices before the natives of the tropical forests had coagulated and rendered them into balls and other shapes; in a word, if it were possible to make these coagulations at the works, but in definite forms, appropriated to all usual necessities. If this could be done, the enormous and costly plant, the complicated, long and expensive operations, would thus be nearly totally suppressed. Operating in this way, one would but imitate the Indian, who makes for his personal requirements in the forest boots, cartridge bags, hats, and all sorts of objects, but who, knowing nothing of mixing and vulcanizing, necessarily produces unstable articles. If, however, he knew all the marvellous properties of the latex, he could have at hand all the means for fixing the form of his objects.

The properties or qualities were determined 18 years ago by a young doctor of the Faculty of Medicine of Paris, Doctor Morisse, who, sent out by the French Government at the head of a scientific mission from 1887 to 1889, in the regions of the Upper Orinoco and the Rio Negro, in order to especially study latex-bearing trees in those far-off regions, described the dry-smoking of Para rubber and established the antiseptic conditions of the operation. He first used the term antiseptics as applied to rubber, in showing what was the purpose of the smoking, and he determined the rules of chemical operations which it was prudent to practise to prevent the fermentation of the latex, and to prevent it from being resinous, or becoming resinous if exposed to air. Living at some 3,000 kilomètres from the coast with the Indians, and having little but the rubber as raw material, he first of all tried to adapt it to his own personal wants. Then he sought by every means to solve all the mysterious unknown points of this interesting problem, studying the gum at its very source, in the latex, and even in the trees which produced this vegetable milk. The first mission was followed by two others at five years' interval, and the author succeeded so completely that all the ulterior laboratory experiments have but confirmed the laws he laid down, and he may be incontestably called the creator of the first scientific theory of raw rubber.

It is these results, the application of his theories, which, patented everywhere after long, patient and serious controlling experiments, will now permit the manufacture of rubber to be reduced to its most simple expression. If one remembers that the manipulations at present practised in rubber works increase the price of it by at least 30 per cent., in spite of the enormous mass of inert powders, substitutes and inferior gums which good quality rubber is made to absorb; if one considers that an average pneumatic tyre costs from £5 to £15 at wholesale prices, lasts a comparatively short time, and that in France alone tyres to the value of about £2,000,000 were sold in 1904, or about 84,000 covers and an incredible quantity of inner tubes, it is easy to see what an enormous value the new process is likely to have.

The problem to be solved was twofold:—

1. The transport of fresh rubber milk into France without any alteration whatever of its properties.

2. Its coagulation, moulding and vulcanization.

The author's studies, completed by microscopical analyses and a long series of practical experiences, have disclosed all the secrets of the latex, and have permitted him to solve these different problems with relative facility;

bringing them to such a state of perfection that machine manufacturers can immediately commence the making of small plant, that is of the necessary moulds, which this time will be of the most simple form. It was long-denied—for the author of these original experiments on new lines met more than most men with sneering discouragement and criticisms—that it was possible to transport rubber milk in a liquid form over long distances. To-day the evidence of facts must be believed; the latex can be kept fresh for years by appropriate methods extremely simple and not costly, and it is now beginning to arrive in France and in steadily-increasing quantities. The chemical or natural coagulating substances should be such that they can be easily handled and controlled, and the operator should be always sure of the different lengths of time necessary for diverse degrees of coagulation. This difficulty is easily overcome. For instance, one can obtain latex in a state of extreme fluidity or in the form of a cream as thick as desired; this would be specially applied to the proofing of tissues, and replace the usual solution of rubber. This pasty consistence could be equally applied to the repairing of inner tubes, and to all branches where the dipping processes are resorted to.

The Indian of the Amazon and Orinoco valleys requires a much longer time to coagulate the latex than to gather it; the smoke-curing operation, layer by layer, is extremely slow. There is thus no doubt whatever that at the same price he would rather supply latex than loaves of dried gum, if he had no further trouble than that of adding to freshly-gathered latex the necessary substances for preserving it in liquid form. But it may be asked, is it possible to supply the latex in place of the concrete product—the hard fine rubber? It is evident that a solid body is handier and more easily transported than a liquid which requires a special receptacle. Therefore, if the latex has to be brought from the depths of the forest, to a river port, after weeks and months of marching, its transport would certainly be costly and unpractical. In this case it would be better to stick to the old ball of raw rubber, as is necessary in the Congo States, for instance. But when on the contrary one speaks of forests washed by large navigable rivers, as the Amazon, the Orinoco, the Rio Negro, or the Cassiquiare, the latex can be easily transported to the river boats. Take the Orinoco for example. Everywhere there is found a receptacle exclusively used for storing liquids —the demijohn of about five quarts—whole shiploads of them arriving continually from Hamburg. It is this which is used for carrying all liquids, especially the tafia and wine, with which the demijohns are filled at Ciudad Bolivar, for the most extreme points of all this immense valley. Nothing then could be easier than to return them full of latex which could be emptied at the ports of embarkation into zinc tanks carried by the river boats which abound in the region.

As to cost, we may say that in the lower Orinoco districts any latex can be obtained from 2*s.* to 2*s.* 6*d.* per gallon of five litres or kilos; contracts passed with a general prefect, who brings them to the factory itself at these prices, is abundant testimony on this point. The latex contains, more or less, 50 per cent. of pure gum, which brings the price down to one franc per kilo, or 4½*d.* per lb.; compare this with Para, of which the Orinoco districts produce large quantities, and which is worth at present 5*s.* 6*d.* per lb. Or from the Lower Orinoco to Bordeaux the total freight charges are not more than 15 centimes per kilo, roughly 11-16ths of a penny per lb.—a sensible difference between this figure and that paid in the Congo States, where rubber, much inferior to that known as Para, costs from 2*s.* 6*d.* to 3*s.* 4*d.* per kilo for land transport alone, by negro porters to the shipping port. . . .

When it comes to rooting up old habits, to come back to simple methods where complicated ones have always been used, there are plenty of difficulties and resistances, and, above all, unbelievers and scorners. As a matter of fact this routine method is represented by a powerful and prosperous industry, defended by a class of engineers and others who live on it, and who will never yield except to the evidence of an overpowering competition. It is there, in the camp of vested interests, that the enemies of the forthcoming industrial revolution will be found. . . . The manufacturer established his cost prices, and his selling prices in proportion, but with ever-increasing profits, as the demand was generally superior to the supply of rubber goods. Little he cared about where the rubber came from or how it was obtained, so long as it came in plentifully and at a low price, and thus it was that this professional man, who was the only person qualified to guide the Indian in his preparation, in no way troubled himself about modifying a raw material, which in the way he used it gave prosperity to his firm and a dividend to his shareholders. It naturally followed that neither the manufacturer nor his chemist ever troubled or suspected what rubber really was; for the chemist, working on the dried gum, found himself in the same position as a biologist who would pretend to know the properties of human blood by studying a dried clot.

So it was that the two parts of the same industry, the production and the employment, were worked apart, the persons employed in the one part ignoring what happened in the other, and each one followed the routine which gave him pecuniary satisfaction.

Would the production of wine be reduced to an exact science as it is to-day if the wine industry had been so negligent as not to know what grape juice was before its fermentation? But as concerns rubber, the equilibrium between supply and demand has been disturbed, and a cry of alarm has been raised by the manufacturers themselves, who, under the influence of the incessant wants of an industry marching with giant strides, and above all, influenced by the insatiable appetite of that ogre for rubber—the automobile—finds itself on the eve of a famine of the raw material. The most tangible result up to now of this disturbance of equilibrium is that Para has risen from about 7 to 16 francs per kilo, and that it will probably go up to 20 francs, during which time expeditions have been sent in every direction where latex-bearing trees are likely to grow, to find out new sources of production.

Although these expeditions have been prepared by expert manufacturers, no doubt masters of their profession, but absolutely incompetent in colonial matters, and thus incapable to revise either the value or the work of these missions, the latter are doomed to sterility in advance, and have hitherto served but to engulf capital. Even were these attempts well documented and carefully organised, they would still lack for a long time the veritable base and element of success. By this we mean the starting point of any similar mission, and that is colonial experience acquired in a rubber country, which can only be obtained by years of residence, and cannot be bought with gold. There is a big difference between sending a Frenchman to gather apples in Normandy and sending him out to obtain rubber in the virgin forests of the Amazon and Orinoco river basins. The moment thus appears most propitious to bring forth from the laboratory the series of discoveries, and of chemical and physiological observations, which the author had so long guarded for himself and a few initiated ones in the speculative state of simple scientific curiosity. Such is the purpose of the Syndicate for the Industrial Utilisation of Hevea Latex—or rubber milk.

HELPFUL HINTS TO RUBBER PLANTERS.

We think the following hints may help Planters to send their Rubber to the market in the best and most attractive form for Consumers :—

SHAPE AND QUALITY.—

1. BISCUITS.—12 to 14 inches in diameter } About $\frac{1}{8}$ to $\frac{1}{4}$ inch thick.
2. SHEETS.—2 feet long and 1 foot wide }

COLOUR.—Pale-yellowish or amber, smooth surface and clear and transparent. Pale and dark should be kept separate as far as possible.

3. CREPE OR LACE.—Long strips 6 to 8 inches wide, and $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. Pale-yellow or amber colour and as clear as possible.

4. SCRAP.—This should be divided into three piles where necessary, pale, dark, and dirty and barky or heated. The colour should be as pale as possible and substance as gristly as posssible.

DRYING.—The very greatest care should be taken that all Rubber is absolutely dry before being packed, and all showing the slightest traces of heat must be kept separate, as a small amount of heat will spoil a whole case during transit.

PACKAGES MOST SUITABLE.—Boxes or Cases. An iron band at each end is advisable.

WEIGHT.—About 1 to 1½ cwt. each gross.

N.B.—Care must be taken that boxes or cases in which small lots are packed do not tare more than 28 lbs. each, otherwise if the tare is over 28 lbs. the draft allowance is 2 lbs. per case. (See allowances below.)

PAPER.—No paper should be used in packing either biscuits, sheets, or crêpe. A little Fuller's earth is useful sprinkled between the Rubber.

MARKING.—All Biscuits and Sheets (also cases) should be stamped with the Estate mark.

ALLOWANCES.—The customary trade allowances are 2½% discount, and Draft.*

*East Indian Draft on package weighing gross 28 lbs. or under ... Nil
on ,, exceeding ,, 28 lbs. ... ... 1 lb.
but where the tare of the package exceeds 28 lbs. ... 2 lbs. allowed.

These are usual allowances on all East Indian produce, and where not allowed the equivalent would simply be knocked off the price.

LOSS IN WEIGHT.—On the average about 1 to 2 % between port of shipment and London. No loss between landing and delivery as a rule (all samples are returned to cases or paid for).

LONDON CHARGES, &c.—A liberal estimate based on actual sales is as follows :—

Discount	2½ %
Dock Charges about	¾ %
Freight about	¾ %
Sale Charges, including Fire Insurance ...	½ %
Brokerage	½ %
Loss in weight	1¼ %
Actual cost to Shipper	6¼ %

LEWIS & PEAT,
RUBBER BROKERS,
6, Mincing Lane, London.

December, 1905.

The Rubber Market.

PLANTATION GROWN RUBBER IN 1905.

FROM CEYLON, THE STRAITS AND MALAY STATES.

The past year has been a good one for this article. Imports are steadily increasing, and the manufacturers and trade in general are taking more interest, and the prospects for the future are bright.

During 1905, about 45 tons were sold on this market consisting of about 1,400 packages from Ceylon and 1,000 from the Malay Peninsula. At present the weights of packages vary from a few pounds to as much as 4½ cwt. (The latter weight is too heavy—one or two hundredweights being quite enough). Taking the quality all round it has been excellent, especially of the sheets—one or two small lots of the biscuit Rubber have been damp and mouldy, and some lots heated and run together. The scrap has been very mixed, parcels coming pale and dark together, barky and sandy and often heated. Several lots also have had a perished look probably through over drying. It is a mistake to pack Rubber in paper. Several lots of biscuits have been quite spoilt by doing this, and sold at several pence per lb. less than the ordinary loose. A little Fuller's earth can be used.

BISCUITS.—The Rubber in this form has been rather more mixed, both in colour and quality, than last year, and a much larger proportion has arrived a little damp and mouldy, and in some cases badly stuck and run together. Clear pale and amber biscuits are wanted, but several lots have been mottled and patchy. Prices have ranged from 5/11 a 6/9½ per lb., the top price being paid in May. Some very well-prepared lots of Ceara biscuits have been sold generally at about 2*d.* or 3*d.* per lb. less than the Hevea, but in some instances the same prices were realised

SHEETS.—There is a tendency for shipments in this shape to be taken in preference to biscuits, and we have seen some very fine parcels, nearly all from the Straits, clear amber colour and measuring about 2 ft. by 1 ft. Where possible we recommend the Rubber to be prepared in this shape. One lot of very fine thin amber sheets from Highlands Estate, Klang, fetched 1*d.* per lb. over anything else at the sale, but as a rule prices have nearly always run on a parity with biscuits, viz.:—from 6/ up to 6/9½ per lb.

About the finest lot of Rubber sold this year was a lot of specially prepared sheet, which came from the Highlands Estate, Klang, with a Crêpe consignment in November.

SCRAP.—Most parcels offered have been good, but some of the smaller lots have been very mixed, dark and pale, barky and dirty and often heated and some lots perished; fine clean pale and dark gristly free from bark, dirt and other impurities sell exceedingly well, but any impurity or heat knocks pence a lb. off the price. Fair to fine scrap sold at 3/10 up to 5/8 per lb. Ball scrap sold fairly well at 3/6 a 4/6.

WORM RUBBER.—This way of preparation is not so attractive as biscuits or sheet, and buyers are rather apt to treat it as a form of very fine scrap, although the quality is every bit as good as sheet or biscuits. Only small lots have come to hand and sold at about 5/6 a 6/2 per lb.

CREPE AND LACE.—Some very fine parcels, particularly from the Highlands Estate, Klang, have been sold during the year. The quality and condition has been excellent. Manufacturers are still prejudiced against any Rubber that has been washed or otherwise treated, as a certain amount of the natural fibre and e lasticity is lost in the process, and the true quality of the rubber is much more

difficult to tell in this form, but the prejudice seems wearing off. Prices realised were fully equal to those paid for biscuits and sheets, and fluctuated during the year from 6/9¾ at the top to 6/ at the lowest point.

Rambong.—Some very nice lots of both red and black have been sold at 3/8 up to 4/7½ per lb. More attention would be paid to larger lots and higher prices paid.

Ficus.—Very little has been offered here, but a few lots of beautifully prepared biscuits fetched very high prices, in several cases as much as Hevea.

The closing quotations are:—

For Sheets and Biscuits ... ... 6/1½ per lb.
Crêpe ... ... 6/1¼ ,,
Scrap ... ... 4/6 a 5/3½ ,,
Fine Para ... ... 5/5 ,,

	Highest. 1905.	1904.	Lowest. 1905.	1904.
Plantation Grown Para ...	6/9¾ against	6/1¼	5/11 against	4/6
Ordinary Para	5/9 ,,	5/5	5/0½ ,,	3/11

LEWIS & PEAT.

London, December, 1905.

THE LONDON RUBBER MARKET.

London, December 8th.—Fine Para 5*s*. 3*d*.—At to-day's auction, 73 packages of Ceylon and Straits Settlements Plantation grown rubber were offered, 66 of which were sold. This was again only a small sale, the total quantity offered amounting to about 3¼ tons, Ceylon and the Straits each contributing nearly 1¾ tons. All grades met with satisfactory competition, only a very small proportion failing to realise limits. Excepting in the case of a few small parcels, rates generally showed a little improvement on those ruling at the last auction, there being several buyers of biscuit and sheet qualities at from 5*s*. 7*d*. up to 6*s*. 1¼*d*. per lb. Scrap was also sought after realising from 3*s*. 6*d*. for an unattractive parcel up to 5*s*. 5¾*d*. per lb. Culloden Estate, Ceylon, was represented by a nice invoice of 12 cases weighing a little over one ton and a quarter in all, which realised an average of 5*s*. 9¾*d*. per lb. Average price of Ceylon and Straits Settlements Plantation Rubber.—66 packages at 5*s*. 9¼*d*. per lb., against 80 packages at 5*s*. 9*d*. per lb. at last auction.

Particulars and prices as follows:—

CEYLON.

MARK.	QUANTITY.		DESCRIPTION.	PRICE PER LB.
Dolahena	1	case	Very fine pale sheet ...	6*s*. 1*d*.
do	1	do	Fine clean pressed scrappy sheet ...	5*s*.
Baddegama	1	do	Fine palish and darkish biscuits ...	6*s*. 0¾*d*.
Gikiyanakande	1	do	Fine darkish cuttings ...	5*s*. 1½*d*.
M. (in diamond)	1	do	Rough biscuits and ball scrap ...	3*s*. 6*d*.
Rangbodde	1	do	Good pale biscuits (Ceara) ...	5*s*. 10*d*.
Culloden	3	do	Fine pale biscuits, little mouldly ...	6*s*. 1*d*.
do	1	do	do do thicker...	6*s*. 1¼*d*.
do	1	do	Cuttings ...	5*s*. 5¼*d*.
do	6	do	Fine palish scrap ...	5*s*. 5¾*d*.
do	1	do	Fair dark scrap ...	3*s*. 8½*d*.
Ellakande	3	do	Fine palish biscuits ...	6*s*. 1*d*.
do	2	do	do little darker ...	6*s*. 0¼*d*.
do	2	do	Good pale scrap ...	5*s*. 4*d*.
Hattangalla	1	do	Fine palish biscuits ...	6*s*. 0½*d*.
do	1	do	Good pressed scrap ...	5*s*. 5¼*d*.
S. (in diamond)	2	do	Good pale biscuits (Ceara) ...	5*s*. 3*d*.
do	1	do	Rejected biscuits and ball scrap ...	4*s*. 9*d*.

STRAITS SETTLEMENTS.

MARK.	QUANTITY.	DESCRIPTION.	PRICE PER LB.
Tiger Asahan	3 cases	Fine palish biscuits	6*s.* 1*d.*
Bukit Lintang	1 do	do	6*s.* 0¾*d.*
Bukit Buyong	1 do	Fine pressed cuttings	5*s.* 10¾*d.*
C. K. C. (in diamond)	2 pkgs.	Good pressed scrap	4*s.* 7½*d.*
M. B. (E. in triangle)	1 case	Ball scrap	4*s.* 6*d.*
do	1 do	Pressed scrappy sheet	4*s.* 5*d.*
S. K. (in diamond) P. R.	1 do	Thick scrappy sheet, whitish inside	4*s.* 11½*d.*
L. & P. F. M. S.	4 do	Fine pale washed crêpe	6*s.* 1*d.*
do	10 do	do trifle darker	6*s.* 1*d.*
do	2 do	do darker	6*s.*
do	1 do	do very dark	5*s.* 7*d.*
M.	5 do	Fine large palish biscuits	6*s.* 1*d.*
do	1 do	Fair cloudy biscuits	5*s.* 11*d.*
do	2 do	Good clean palish scrap	5*s.* 3*d.*
do	1 do	Good scrap and rejected biscuits	5*s.* 3*d.*

ASSAM RUBBER

There were also offered 33 bags of Assam Rubber, all of which found buyers at from 1*s.* per lb. for a low heated parcel, up to 3*s.* 7¾*d.* for fair quality.

London, December 19th.—Fine Para 5*s.* 5*d.*—At to-day's auction, 77 packages of Ceylon and Straits Settlements Plantation grown rubber were offered, 66 of which were sold. The aggregate quantity amounted to nearly four tons and three quarters, Ceylon contributing 2½ tons, and the Straits rather less than 2¼ tons. The auction was characterised by good competition, fine quality particularly being in request at up to 6*s.* 1½*d.* per lb. There was only a small quantity of scrap offering, and this was mostly disposed of at from 3*s.* per lb. for a small bag of unattractive quality up to 5*s.* 3½*d.* for a fine parcel of Ceylon. Average price of Ceylon and Straits Settlements Plantation Rubber.—66 packages at 5*s.* 10¼*d.* per lb., against 66 packages at 5*s.* 9¼*d.* per lb. at last auction.

Particulars and prices as follows:—

CEYLON.

Ellakande	2 cases	Fine small pale and darkish biscuits	6*s.* 1¼*d.*
do	1 do	Good palish scrap	5*s.* 3½*d.*
Heatherley	6 do	Fine pale biscuits, little mouldy	6*s.* 1½*d.*
do	5 do	Fine scrap	5*s.* 3½*d.*
do	1 do	Fair darkish scrap	5*s.*
Nikakotua	3 do	Fine palish cloudy biscuits	6*s.* 1¼*d.*
do	1 do	Good dark biscuits (mouldy)	6*s.* 0¾*d.*
do	4 do	Good palish scrap	5*s.* 3*d.*
do	1 do	Good ball scrap	4*s.* 3*d.*
Arapolakanda A.P.K.A.I.	8 do	Very fine large dark biscuits, few palish	6*s.* 1*d.*
do B.I.	4 do	Fine dark scrap	5*s.* 1½*d.*
M. M. (in diamond)	1 do	Good pale and darkish biscuits	6*s.*
do	1 bag	Good scrap and cuttings	4*s.* 9*d.*

STRAITS SETTLEMENTS.

L. & P. F.M.S.	1 case	Very fine pale washed ribbon	6*s.* 1½*d.*
do do	3 do	do do (thicker)	6*s.* 1*d.*
do do	3 do	Very fine pale washed crêpe	6*s.* 1¼*d.*
do do	2 do	Very fine amber sheet	6*s.* 1¼*d.*
do do	1 do	Good sheet scrap	5*s.* 0½*d.*
S. (in diamond) R.R.	3 do	Fine clean presssd sheet	6*s.* 1*d.*
S. do S.R.	1 do	Dark scrap	3*s.* 4*d.*
Add L. E.	1 do	Good palish sheet	6*s.* 1*d.*
MUAR (in triangle) Straits	4 do	Very fine palish scored sheet	6*s.* 1¼*d.*
do	1 do	do do little darker	6*s.* 1¼*d.*
do	1 do	Pressed scrap and Rambong sheet	4*s.* 7*d.*

MARK.	QUANTITY.	DESCRIPTION.	PRICE PER LB.
A.B.C. (in diamond)	1 do	Good small darkish biscuits	... 6*s.* 1*d.*
do	1 bag	Rejected biscuits and scrap	... 3*s.*
J. B. 2	1 case	Good hard pressed scrappy sheet	... 4*s.* 11½*d.*
do	1 do	do do little darker	.. 4*s.* 11½*d.*
B.N.S.	1 do	Very fine thin pale sheet	6*s.* 1½*d.* bid
do	2 do	do do little darker	... do
do	1 do	do do and biscuits	... do
do	1 do	Very fine pale scrap	... 5*s.* 3*d.*
do	1 do	Fine scrap	... 5*s.* 1½*d.*
S. P. (in circle)	1 do	Good palish biscuits (mouldy)	... 6*s.* 1*d.*

ASSAM RUBBER.

There were also included 9 bales of Assam Rubber, which comprised a very fine invoice of clean plantation quality, which realised from 4*s.* 9*d.* to 4*s.* 10*d.* per lb.

London, January 5th, 1906.—At to-day's auction, 233 packages of Ceylon and Straits Settlements Plantation grown rubber were offered, 183 of which were sold. This was a very interesting offering amounting in all to nearly ten tons, Ceylon contributing about 3¼ tons and the Straits 6½ tons. There were several good sized parcels both of fine washed crêpe, sheet and biscuit, an exceptionally attractive one consisting of 33 cases of very fine long sheets cut in strips from the Bukit Rajah Co., for which, however, the owners' idea was not obtainable in the room. In addition to this grade the invoice included 19 packages of other kinds, the total weight amounting to just over two tons. For finest quality 6*s.* 1½*d.* was the price generally paid, one or two lots realising 6*s.* 1¾*d.*, and 2 cases of washed crêpe brought 6*s.* 2*d.* There were also some nice parcels of scrap which were well competed for, prices ranging from 5*s.* to 5*s.* 6¾*d.* for fine qualities down to 3*s.* 4¼*d.* for the lowest grades Average price of Ceylon and Straits Sttlements plantation rubbber.—183 packages at 5*s.* 10*d.* per lb., against 66 packages at 5*s.* 10¼*d.* per lb. at last auction.

Particulars and prices as follows:—

CEYLON.

Tallagalla	3 cases	Good palish to dark cloudy biscuits	... 6*s.* 1½*d.*
do	1 do	Good clean palish scrap	... 5*s.* 3¼*d.*
Sorana	2 do	Fine palish biscuits	... 6*s.* 1¾*d.*
do	1 do	Fine palish to darkish biscuits	... 6*s.* 1½*d.*
Warriapolla	2 do	Very fine pale amber biscuits	... 6*s.* 1¾*d.*
do	3 do	Fine pale biscuits	... 6*s.* 1½*d.*
do	2 do	Fine clear palish biscuits	... 6*s.* 1½*d.*
do	1 do	Good do	... 6*s.*
do	1 do	Fine very dark biscuits	... 6*s.*
Ambatenne	3 do	Fine palish biscuits	... 6*s.* 1½*d.*
do	2 do	Good darkish scrap	... 5*s.*
Heatherley	1 do	Fine do	... 4*s.* 11*d.*
Culloden	4 do	Fine pale amber biscuits	... 6*s.* 1½*d.*
do	2 do	do (rather mixed)	... 6*s.* 1*d.*
do	1 do	Good cuttings	... 5*s.* 2½*d.*
do	3 do	Fine palish scrap	... 5*s.* 3¾*d.*
do	2 do	Dark scrap	... 3*s.* 4¼*d.*
Ellakande	1 do	Fine palish to dark biscuits	... 6*s.* 1½*d.*
do	1 do	Fine palish scrap	... 5*s.* 3*d.*
do	1 do	Good darkish biscuits	... 6*s.* 1½*d.*
do	1 do	Good darkish scrap	... 5*s.* 1¼*d.*
Ingoya	4 do	Very fine clear amber biscuits	... 6*s.* 1¾*d.*
do	1 do	Fine palish and darkish biscuits	... 6*s.* 0½*d.*
do	2 pkgs.	Fine clean scrap	... 5*s.* 1*d.*
K. K.	3 cases	Fine palish to dark biscuits	... 6*s.* 1¼*d.*
do	1 bag	Good scrap and cuttings	... 5*s.* 1¾*d.*
Halwatura	5 cases	Fine palish to darkish scrap	... 5*s.* 3¾*d.*
Katugastota	1 do	Fine palish and darkish biscuits	... 6*s.* 1½*d.*

MARK.	QUANTITY.	DESCRIPTION.	PRICE PER LB.
Halgolla	1 case	Fine pale amber and dark biscuits	6*s*. 1½*d*.
Galatura	1 do	Fine large darkish biscuits	6*s*. 1½*d*.
Halgolla	2 do	Fine pale and dark biscuits	6*s*. 1½*d*.
Madampe	1 do	Good palish to darkish biscuits	6*s*. 1½*d*.
do	1 bag	Palish scrap	3*s*. 6*d*.
Waharaka	1 case	Good palish biscuits	6*s*. 1½*d*.
Doranakande	2 do	Fine palish scrap	5*s*. 3*d*.
do	1 do	Good darkish scrap	4*s*. 10*d*.
do	2 do	Fine palish to dark cut sheets	6*s*. 1½*d*.
do	1 bag	Good scrap	5*s*.

STRAITS SETTLEMENTS.

MARK.	QUANTITY.	DESCRIPTION.	PRICE PER LB.
W. P. M. Teluk Batu	7 cases	Fine amber sheet	6*s*. 1½*d*.
do	1 bag	Good palish dull sheet	6*s*. 1*d*.
do	1 do	Fine Rambong sheet	4*s*. 6*d*.
do	1 case	Good palish scrap	5*s*. 4*d*.
do	1 bag	Good pressed Rambong sheet	4*s*. 6*d*.
B. L. C. A.	5 cases	Fine pale washed crêpe	6*s*. 1½*d*.
do	1 do	Fine amber sheet and biscuit	6*s*. 1½*d*.
do	1 do	Fine amber sheet	6*s*. 1½*d*.
S. P. (in circle)	3 do	Fine palish biscuits	6*s*. 1½*d*.
do	1 do	Fine clean scrap	5*s*. 2*d*.
S. P. S. (in circle)	2 pkgs.	Thick scrappy biscuits and darkish scrap	5*s*.
do	1 case	Rejected biscuits and scrap	5*s*.
S. R. C. (in triangle)	27 do	Good large palish to dark biscuits	6*s*. 1½*d*.
L. & P. F. M. S.	5 do	Fine pale washed ribbon	6*s*. 1¾*d*.
do	2 do	Fine pale washed crêpe (in rolls)	6*s*. 0½*d*.
do	1 do	do darker	5*s*. 10½*d*.
do	1 do	do do	5*s*. 7¼*d*.
D. K. P. C. L.	4 do	Fine palish biscuits	6*s*. 1½*d*.
do	2 do	Fine pressed scrappy sheet	5*s*. 6¾*d*.
do	2 do	Good palish scrap	5*s*. 3½*d*.
A. G. & Co.	1 do	Fine palish to darkish cut sheet	6*s*. 1½*d*.
B. R. R. C. O.	33 do	Very fine palish amber long strips	6*s*. 1½*d*. offered
do	8 do	Good palish to darkish scrap	5*s*. 3½*d*.
do	2 do	Good clean palish scrappy sheet	5*s*. 3¾*d*.
do	1 bag	Good scrap	5*s*. 2*d*.
do	5 cases	Pressed dark Rambong scrappy sheet	5*s*. 2*d*.
do	1 do	do	5*s*. 1½*d*.
Highlands Estate	7 do	Fine palish washed crêpe sheet	Part sold 6*s*. 2*d*.
do	5 do	do darker, greyish	6*s*.
do	2 do	do palish to dark	5*s*. 4¾*d*.
do	4 do	Fine palish washed crêpe sheet	5*s*. 10*d*.
do	9 do	do greyish to dark	5*s*. 1½*d*.
do	4 do	Darkish washed crepe sheet	5*s*. 3*d*.

ASSAM RUBBER.

Assam and Rangoon were only represented by 14 packages, 8 of which consisted of fair red No. 1, which realised 3*s*. 6*d*.

GOW, WILSON & STANTON, LTD.

OILS AND FATS.

CEYLON CITRONELLA OIL IN 1905.

During the last six months the prices have only fallen away very slightly, and not for spot, but for autumn shipments. Prompt oil is in great request and fetches full prices. The total shipments from Ceylon during the period from 1st January to 31st July of this year amounted to 682,443 lbs., and are distributed over the different countries as follows:—

United Kingdom	249,490 lbs.
America	320,908 ,,
Germany	54,555 ,,
Australia	41,600 ,,
China	8,836 ,,
India	1,334 ,,
France	5,720 ,,
Total...	682,443 lbs.

a figure for seven months, from which it may be concluded that the quantity exported in 1905 will exceed that of the previous year; the consumption of this perfume is still growing.

The Report of 1904 of the Royal Botanical Garden of Ceylon contains very interesting information on the experiments made in planting citronella of the Maha-pangiri variety. From an area of one acre planted in July, 1902, the following crops have been gathered:—

In March, 1904,	10,809¼ lbs.	yield of oil	about	48 lbs.
In August, 1904,	8,511 ,,	do	do	36 ,,
Total in 1904,	19,310¼ lbs.	yield of oil	about	84 lbs.

This shows that exactly 230 lbs. of grass yielded 1 lb., of pure citronella oil. A further crop from the same acre will be harvested in January, 1905. Another plantation produced within six months 16,083 lbs. grass per acre, with 60 lbs. yield of oil; a third, planted in June, produced in December 9,765 lbs. fresh grass yielding 49½ lbs., of oil per acre. It is clear from these figures that the citronella cultivation, in view of the low value of the ground and the cheap labour in Ceylon, cannot be so unremunerative as it is frequently represented to be, the more so, as the value of the oil appears to become permanently firmer.

Judging from the citronella oils which have been examined in our laboratory, it seems that the coarser adulterations of the oils with petroleum are now discontinued in Ceylon; at least, we have no longer been compelled to reject oils on account of deficient solubility in 80 per cent. alcohol (Schimmel's test). On the other hand, there was a large number of oils which did not pass Schimmel's raised test. The latter, as is well known, requires that citronella oil after 5 % Russian petroleum is added, shall show nearly the same solubility as the pure oil; especially, after diluting one volume of the oil mixed with petroleum with ten volumes 80 per cent. alcohol, no separation of small drops of oil shall be noticeable. The oils which did not pass this raised test were also almost throughout inferior on account of their low geraniol-content, which was found down to 51, 6 %

Worse adulterations which we have observed, were this time of quite a different character. A sample sent to us from Marseilles, which was suspected on account of its low specific gravity, was found to be adulterated with 11, 2 % alcohol. This sample had the following properties: d15° 0, 8899; ªD—9° 15'; total geraniol 67, 3 %; soluble in every proportion in 80 per cent. alcohol; the dilute solution had a faint opalescence. By simply extracting with a solution of common salt, the alcohol added was extracted from the oil, and consequently the total content of geraniol was lowered considerably, as previously the alcohol had naturally been included in the calculation of geraniol. The properties of the extracted oil were as follows: d15° 0, 8969; ⁿD20° 1, 47166; 58, 6 % total geraniol; soluble in 0, 5 and more volumes 80 per cent. alcohol; the dilute solution had a faint opalescence.

Of much more interest was another case where it was a question of an oil which was said to have spoilt the soap in a silk factory. Whether the fault was exclusively due to the oil in question we are unable to say, as we are not acquainted with the other circumstances. But this much is certain, that the examined oil was largely adulterated with lemon oil terpenes. The result of the examination was as follows: d15° 0, 8852; ªD+11° 44'; ⁿD20° 1, 47235; 29, 6 % total geraniol; not soluble in ten volumes 80 per cent. alcohol. For comparison we also quote the values accepted as normal for Ceylon citronella oil: d15° 0, 900 to 0, 920; ªD to the left up to—21°; total geraniol at least 57 %.—*Semi-Annual Report of Schimmel & Co.*, November, 1905.

CLASSIFICATION OF COCONUT OIL IN AMERICA.

The U. S. A. Treasury Department recently made an important discovery with regard to the action of the Department of Justice upon a decision of the United States Circuit Court for the district of Oregon with regard to the dutiable classification of so-called cocoanut oil. The decision referred to held this product to be entitled to free entry, but in promulgating the text of the opinion of the court the Treasury Department announced that the Attorney-General would take an appeal to the United States Circuit Court of Appeals. Custom officials naturally assumed that such an appeal was in fact taken, and that the case was still pending in the upper court, and, therefore, assessed duty on importations of cocoanut oil at several ports. The Treasury Department, however, was recently informed that, after thorough investigation, the Attorney-General had decided to abandon the case, and it is understood that general instructions will be sent to collectors at all ports to admit this product free of duty.

The case ruled upon by the United States Circuit Court was that of the United States *vs.* the Oriental American Company. The defendant imported 46,912 pounds of refined cocoanut oil, which was so classified by the customs officers, but which after analysis by the United States chemist at New York was re-classified, under instructions from the Secretary of the Treasury to the Board of General Appraisers, as "cocoa-butter or cocoa-butterine," under paragraph 282 of the tariff act of 1897. When so re-classified, the merchandise instead of being entitled to free entry became liable to a duty aggregating $1,641·92, for the recovery of which suit was brought by the United States. In deciding this issue the Circuit Court, in a comprehensive decision covering a variety of similar products, said, in part:—

"Cocoa-butter is produced from the beans of the cacao or chocolate tree, the word 'cocoa' used in this connection being a corruption of the word 'cacao.' The importation in question is made from the fleshy part of the cocoanut, a product of the cocoa palm. All products made in imitation of cacao or cocoa-butter, and adapted to its use, are classified as cocoa-butterine, and are dutiable.

"It is conceded by the government that the importation in question is refined cocoanut oil. The reason given for classifying it otherwise is that it is in fact cocoanut oil deodorized and prepared for edible purposes; that the refining process had rendered it agreeable to the taste and edible, and that it is not placed on the market under the name of cocoanut oil, but under various names indicating a different product and use from cocoanut oil, such as 'Mannheim butter,' 'vegetable butter,' etc.

"The refining process which constitutes what is called the 'manufacture' of the oil, merely removes from it the impurities due to the manner in which the kernel is handled and dried, and to its partial decay. There is no standard of impurity by which the cocoanut oil of commerce is known. That oil, for anything that appears to the contrary, may be a pure and edible oil. An edible cocoanut oil is not a butter because it is edible. Other vegetable oils, like olive oil and cottonseed oil, are edible, and with butter are used in culinary purposes by Chinamen in the Straits Settlements. It must be assumed that whether an oil is an oil or a butterine does not depend upon the degree of rancidity it has, by which its general culinary use is affected. A product to be dutiable as cocoa-butterine must be useful as a substitute for cocoa-butter. It must be an artificial substitute for cocoa-butter. Such is the holding of the Board of General Appraisers.

"As already appears, cocoa-butter is a product of the bean of the cacao or chocolate tree. The oil from cocoanuts, to be classed as cocoa-butterine, must be an imitation of this cacao or cocoa-butter—it must, in other words, be an artificial cocoa butter. The testimony in the case shows a wide difference between the two articles. One of the witnesses, a dealer who has sold cocoanut oil of the manufacture in controversy for a year and a half, testifies that he never offered it for sale or knew of anyone else offering it as cocoa butterine; that it differs in appearance from cocoa-butterine; that there are of the imported butterines and those manufactured here some 12 or 15 different cocoa butterines; that they are all solids, with a melting point of about 90 degrees Fahrenheit, and are usually sold in cakes, wrapped in paper and packed in cases, while the oil in question melts at about 80 degrees completely and becomes a liquid, and is sold in hermetically sealed packages; that the two products differ in color, in texture, and in the use to which they are applied; that cocoa-butterine is sold to confectioners and pharmacists as a substitute for cocoa-butter; that in the pharmaceutical trade the cocoa-butter and butterines are largely used for suppositories; that they are similar in colour, in texture, in the nature of the fracture when broken, and in the degree of melting; that in many cases the odour of the cocoa-butter is attempted to be introduced in the butterines, not always successfully, but that they are put up in the same manner, packed in the same weight of packages, and bear, as nearly as an imitation may bear, all the characteristics of cocoa-butter; that they are readily recognized by everyone in the trade; that confectioners refuse to buy the oil in question because its low melting point makes it entirely unsuitable as a substitute for cocoa-butter. The testimony of the confectioners is that the importation in question is not used as a substitute for cocoa-butter; that any sweet, clean fat can be used to a limited extent in thinning chocolate; that most fats dissolve at a very low degree, while cocoa-butter, because it melts at a higher degree, is more suitable for thinning chocolate, 'so the chocolate won't dissolve and spread,' and that in the confectioner's business cocoa-butter is chiefly used for this purpose. Some of these witnesses testified that they had used the cocoanut oil in question, but it was not successful; that it was no more suitable for their use than lard or cottonseed oil. From the testimony in the case it appears that this cocoanut oil is used chiefly for soap making, and that more than three-fourths of the importation on account of which this action is brought was purchased by one manufacturer for such use.

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"From these facts, I conclude that the merchandise in question is not an imitation of nor a substitute for cocoanut butter, and that it is not dutiable under the tariff act."—*Oil Reporter, New York.*

[In connection with this interesting decision of the U.S.A. Circuit Court of Appeal we have to remark that it is to be regretted that a difference in spelling of these products is not adhered to. A certain amount of confusion is always liable to arise when the commercial products of the two plants *Theobroma Cacao* and *Cocos nucifera* are both spelled "cocoa." Cocoa is a correct spelling of cacao products; "coco" the spelling for the coconut palm and its products.—Ed. *T. A. & Mag. C. A. S.*]

TESTING OF COPRA OIL FOR PURITY.

The use of copra coconut oil for soap making has of late years increased enormously, and hardly in a less degree for the manufacture of alimentary vegetable fats. It is often mixed with less expensive oils, such as cottonseed, sesame, arachis and even hydrocarbon oils, at the risk of altering its properties and causing serious injury to the industries in which it is used.

Alkaline Saturation.—5 grams of the pure, dry, fatty acids from copra oil require 24·1 c.c. of normal soda, whereas 17·7 c.c. are sufficient to saturate seed oils.

Solubility in Absolute Alcohol.—Neutral copra oil is the only fatty oil which dissolves completely in two volumes of absolute alcohol at a temperature of 32 deg. C., with the exception of castor oil, from which it can readily be distinguished by other characteristics.

Iodine Value.—No other fatty oil possesses such a low iodine value as copra oil, namely, 9 per cent. of iodine. That of other vegetable oils varies between 84 and 105. That is, therefore, a very important distinguishing test.

Sulphuric Acid Saponification.—Maumene's process applied to copra oil (at 17-18 deg.) gives good indications, as the temperature obtained exceeds those of other vegetable oils by 50 deg. It is curious that this most distinctive test is not generally used.

Volatile Acids.—The determination of the volatile acids, soluble and insoluble, also serves as another test for the purity of copra coconut oil.

Nitric Acid Test.—A simple agitation of the oil with an equal volume of nitric acid at 40 deg. gives useful indications. Copra oil remains unaltered when it is pure and clear, but becomes sensibly brown by the addition of 5 per cent. of seed oils.

Sulphuric and nitric acids combined, employed in the proportions indicated by Cailletet for the purity of olive oil, furnish most distinct indications with copra oil. Now, thanks to these means of investigation, the analysis of copra oil has been attended with success and its adulteration has greatly diminished, so that it is usually only practised in small proportions, which consequently are the most difficult to detect. For instance, with an admixture of 5 per cent. of another oil, instead of 24·1 c.c. of soda, for saturating 5 grams of the fatty acids, 23·8 c.c. would be required, but as it is not impossible to meet with a pure oil saturated by only 23·8 c.c., a doubt would exist; nevertheless, the benefit resulting from such a mixture is still considerable, sufficient to tempt the unscrupulous.

The special reactions which characterize certain seed oils, will give, in such small proportions, very faint indications or even none at all when these oils have been subjected to an apropriate chemical treatment. The test for arachis oil will be particularly delicate, the crystallisation of a few milligrams of arachidic acid takes place with difficulty in the whole mass. It may also be remarked that these different operations are inconveniently long and minute when a rapid report is required and is often indispensable; a process, therefore, by which it is

proposed to remove these defects, is based on the simultaneous action of phloroglucine and resorcine in an acid medium; the sensitiveness and certainty of the reaction is diminished if only one of these substances is employed. Both phloroglucine and resorcine have been proposed for testing the purity of olive oil, but the results obtained did not offer any great certainty, olive oil having a very similar composition to seed oils, and even giving doubtful reactions itself, while old seed oils, or those changed by a preliminary refining produced no colouration at all. This is not the case with copra oil, because it only contains about one-tenth of non-saturated liquid glycerides, whereas seed oils and olive oil have about nine-tenths, being in consequence much more sensitive to the action of the reagents.

Mode of Operation.—The temperature of the reagents and the oil should be 10-12 deg. C.; the oil should be clear and free from water; if necessary, it should be filtered. Pure 40 deg. nitric acid is required free from nitrous oxides; a freshly opened bottle is best. The phloroglucine and resorcine should be quite pure, of recent preparation, and protected from the warmth and vapours of the laboratory. The saturated solutions should be made the same day, employing perfectly pure ether and benzine. It is needless to add that all apparatus used should be scrupulously clean. Having taken these precautions 4 c.c. of the copra oil are placed in a 15 c.c. graduated tube, and 2 c.c. of the saturated solution of phloroglucine in ether added; when dissolved 2 c.c. of the solution of resorcine in benzine are added. The tube is then immersed in water at about 10 deg. C., care being taken that not the least drop enters the tube; it is then withdrawn and 4 c.c. of nitric acid (40 deg.) added. The whole is then transferred into a clean test tube and violently agitated for five seconds; if no reaction is produced the contents of the tube are well shaken up at intervals, attentively observing the oil all the while.

Copra oil remains perfectly clear and is practically unaltered, negligible traces of impurities give a rose tint, hardly perceptible and rapidly disappearing. The addition of any seed oil, such as arachis, sesame, cottonseed, poppy seed rape, castor, etc., in the proportion of 5 per cent. and more, produces a bright red colouration, quite characteristic, which remains some seconds. Tallow and the oleonaphthas give the same colourations. Olive oil also produces the reaction, although less perceptibly; the process cannot, therefore, be used for determining its purity. Pure butter and lard are not affected, and consequently the presence of tallow or seed oils can be detected in these bodies by this test, but with less certainty and sensitiveness than in coprah. It is not necessary to take into account the reactions which are subsequently produced under the prolonged action of pure nitric acid. In short, copra oil can be rapidly tested by this method, which responds to the needs of the numerous industries in which it is used so largely; it is distinct, sensitive and can be applied in a few minutes. The determination of the constants has always agreed with the indications it has given. It is as well to carry out a second test simultaneously in which 5 per cent. of arachis oil has been added to copra oil for comparison.

The action of pure hydrochloric acid and fresh sesame oil:—It is well known that old or altered seed oils do not give the same reactions as the fresh oils. Cottonseed oil which has been heated, for example, does no longer reduce silver nitrate. The process just described preserves the same value in all cases. If the intermixture is made in sensitive proportions the presence of an altered oil in copra oil can be detected by pure hydrochloric acid, after adding fresh sesame oil. Thus a cottonseed oil, insensible to the ordinary reactions is mixed with the copra oil, and, after ascertaining that the phloroglucine-resorcine reaction has not lost its insensity, fresh sesame oil is added to the same mixture, and the whole shaken up with an equal volume of pure hydrochloric acid. In a few seconds the acid layer acquires a fine characteristic green colour. Old or altered sesame oil, which does not become red by the action of hydrochloric acid in the presence of sugar or furfurol, gives a green colouration by the addition of fresh sesame oil and pure hydrochloric acid. Pure, old, or altered copra oil is not sensitive to this reagent.—*Les Corps Gras Industriels.*

DRUGS AND MEDICINAL PLANTS.

Ayapana (*Eupatorium Ayapana*).

A REPUTED VALUABLE MEDICINAL PLANT.

By H. F. Macmillan.

(Illustrated.)

History.—The name Eupatorium is said to have been given to this genus of plants in honour of Eupator, King of Pontus, who discovered one of the species to be an antidote against snake poison. The genus is a large one, containing some 400 species, mostly natives of North and South America. A considerable number of these appear to be credited with the possession of medicinal properties of more or less importance in the countries to which they are indigenous. A few find prominence in the Pharmacopœias of Europe, and one species (*E. ribaudianum*) has recently come into prominence as a reputed source of sugar. Hitherto, however, the one which has claimed most attention from a medicinal point of view is that which forms the subject of these notes. "Ayapana" is the native name given to this plant in Brazil, and it has therefore been retained by the botanist Ventenat, its discoverer, in the scientific appelation of the species. It is a native of the valley of the Amazon, being also found wild in Cayenne and other places in Northern South America. Unlike prophets, plants usually seem to be accorded most honour in their native country. This does not strictly apply to "Ayapana," for although it does not seem to have yet been included in European Pharmacopœias, its fame has spread somewhat widely in parts of Asia and other countries, distant from its original home. Thus the plant has long ago been introduced into Mauritius, Réunion, Ceylon, India, Java, &c., and in almost all these countries has attracted attention as a medicinal plant, its merits being invariably acknowledged by those who have become acquainted with them. Its introduction into Mauritius and neighbouring islands, on the authority of Baker, in his *Flora of Mauritius and Seychelles*, dates from 1797. According to Dr. Ainslie it was brought thence to India, for, fifteen years later, in his *Materia Medica of Hindoostan*, he states that "it is as yet but little known amongst native practitioners." Again, in 1826, Dr. Ainslie mentions that the plant was then in great repute in Mauritius for its medicinal properties. Mr. Dyer had informed Dr. Ainslie that the plant was being cultivated in the island of Bourbon for the purpose of exporting the dried leaves to France. A "Catalogue of Plants growing in Bombay and its Vicinity," published by John Graham, in 1839, gives Ayapana as being cultivated in Gardens at Bombay, as it is to the present day. In Warming's *Pharmacopœia of India*, (1868), it is stated (incorrectly) that the plant is naturalized in Ceylon as well as "in various parts of India, Java, &c." Dr. Dymock, in 1883, (vide *Materia Medica of Western India*) observed that the plant had been cultivated in India for a considerable time. According to Dragendorff in his *Die Heilpflanzen*, published in 1898, Ayapana is "partly cultivated in Java," where it is considered to be of medicinal value. Mr. D. Hooper, Official Reporter of Economic Products to the Government of India, writing in *Indian Planting and Gardening*" in November of 1903, says that the plant is not uncommon in gardens in Bombay and Bengal, and, "though not widely known, is held in considerable esteem by those who are acquainted with it." The exact date of its introduction at Peradeniya is not known. I have not seen it outside the Botanic Gardens, though in the last few years a certain number of plants have been issued to

Photo by H. F. Macmillan.

EUPATORIUM AYAPANA, *Vent.*

("AYAPANA.")

applicants. That Ayapana has found here congenial conditions is evident, though it shows no attempt at spontaneous reproduction, seldom producing fertile seed.

USES.—Belief in the virtues of Ayapana appears to be as yet mostly confined to its native home and some tropical countries to which it has been introduced for cultivation. It is not generally given in the standard Pharmacopœias of Europe, though these include other species of Eupatorium of probably less reputation medicinally. It has been suggested as possible, however, that this is due to want of a thorough knowledge of the properties of Ayapana. It sometimes happens that the virtues of some exotic plants have been so unduly extolled by native practitioners as to preclude European physicians from placing any faith in them. A good example of this is the Chinese "Ginseng," which in China is regarded as a miracle worth its weight in gold, but though acknowledged to possess certain unimportant medicinal properties it is generally discarded by physicians of other countries. On the other hand the belief is held by some people that every country furnishes remedies for such maladies as the natives of the soil are naturally subject to. At any rate, it seems reasonable to suppose that much of the value of the medicinal principles of plants depends upon a proper knowledge of their preparation, and that this can at least to some extent be claimed by the people who from necessity make use of them habitually. Dr. Lindley remarked in his *Flora Medica* that "it by no means follows that plants are inert because medical men reported unfavourably upon them." It has also been asserted that the beneficial effects of plants may vary with the climate in which they are administered, for, according again to Dr. Lindley, "the heat of a country, its humidity, food, and the social habits of a people will predispose them to varieties of disease for which the drugs of Europe offer no effectual remedy; that which may be relied on in one country may be almost worthless in another." Dr. Waring, in his *Pharmacopœia of India* (1868) thinks that Ayapana may have "fallen into unmerited neglect." Amongst the earliest references to it in India are those by Dr. Ainslie, who first in his *Materia Medica of Hindoostan*, dated 1813, states that the "native practitioners believe it to possess medicinal qualities, owing to its pleasant sub-aromatic, but peculiar smell." It would thus appear as if its use by practitioners were sometimes prompted by the characteristic odour of the plant. To this is added, "An infusion of the leaves is a pleasant diet drink, and when fresh and bruised they are one of the best and safest applications I know of for cleaning the face of a spreading ulcer." In a later edition (1826) Dr. Ainslie mentions Ayapana as being of great repute in Mauritius, especially as an alterative and antiscorbutic, adding, however, that "as an internal remedy it has hitherto much disappointed European physicians." He was informed that the dried leaves were imported from Bourbon to France, where they were "used as a substitute for the tea of China." It has since been recorded by Bouton, who wrote on the medicinal plants of Mauritius, that Ayapana holds a high place amongst the medicinal plants of that island, (a statement which many people will corroborate at the present day), being there "in daily use in the form of infusion, in dyspepsia and other affections of the bowels and lungs." In the cholera epidemics in Mauritius, in 1854-56, Ayapana "was extensively used for restoring the warmth of the surface, the languid circulation, &c." Dr. Lindley in his *Flora Medica* says the plant is considered in Brazil to be "a sudorific and alexipharmic, being also used as an antidote against the bite of venomous snakes and insects." Warming, in *Pharmacopœia of India* says, "The whole plant is aromatic, with a slightly bitter, sub-astringent taste. The exaggerated ideas of its virtues formerly entertained are now exploded; but there is reason to believe that it is a good stimulant, tonic, and diaphoretic." Dr. Dymock states, in *Materia Medica of Western India*, that Ayapana may be com-

pared to Chamomile in its effects, being stimulant and tonic in small doses, and laxative when taken in quantity; the hot infusion is emetic and diaphoretic, and may be given with advantage in the cold stages of ague and in the state of depression which precedes acute inflammatory affections. The infusion may be made with one ounce of the herb to a pint of water, to be given in two-ounce doses every three hours. Mr. E. H. Edwards, formerly a planter in Ceylon, writes to Mr. Westland of Matale, that he had successfully introduced the plant into Hawaii, through Peradeniya, and adds, "I consider it to be the best cure in the world for indigestion. In cases of skin affections, too, fomenting with Ayapana leaves has a magic effect. I speak from experience. It makes a splendid liqueur also." Baron von Mueller included "Ayapana" in his book on *Select Plants for Extra-Tropical Countries* (*1880*).

Analysis.—On the authority of Mr. Hooper, already quoted, the drug has been chemically examined by Dr. Warden, formerly Chemical Examiner to the Government of Bengal, with the following result:—The odour of the plant is due to a colourless volatile oil, lighter than water. The active principle is a neutral substance soluble in ether and alcohol and crystallising in long needles. It sublimes at a temperature of 159 to 160 deg., and condenses in beautiful brilliant scales and rhombic prisms. To this substance has been given the name of *Ayapanin*. According to Dragendorff the plant contains the principle *coumarine*, which is said to be obtained chiefly from Tonka-bean, and is used in medicine and for flavouring a certain Swiss cheese.

Description.—The plant belongs to the natural order Compositae, and is known as *Eupatorium Ayapana*, Vent., or *E. triplinerve*, Spreng. It is not sufficiently known in Ceylon to be given any vernacular name other than its Brazilian one. In India it is said to be known, according to Warming, by variations of this name, as "Ayapanie" by the Tamils, and "Ayapana" by the Hindoos. Dragendorff gives "Allapa" as another vernacular name by which it is known, where, it is not said. The name "Ayiya-pana" is given in Moon's "Catalogue of Ceylon Plants" (1824), but this is for an Acanthaceous plant. "Akka-pana" is a well-known medicinal plant (*Bryophyllum calycinum* or "Life Plant") amongst the low-country Sinhalese. It may be interesting to know that "Ayiya-pana" and "Akka-pana" mean respectively "elder brother's" and "elder sister's lamp." *Eupatorium Ayapana* is a low, semi-woody shrub, seldom exceeding 4 feet in height, with thin, tender branches, which are inclined to throw out roots at the nodes; leaves long and narrow, opposite, in pairs, their bases almost uniting round the stem, about 4 inches long by ¾ inch broad, fleshy and lanceolate. The foliage generally is of a reddish colour, and when bruised emits an aromatic odour. Flowers purplish, produced at the ends of the branches. The plant is easily propagated by mature cuttings taken from near the base.

Sarsaparilla—*Smilax Officinalis.*

CULTIVATION IN CEYLON.

By Ivor Etherington.

A correspondent writes asking for information regarding "the commercial value of Sarsaparilla root, its cultivation and anything to help the sale of a shipment." He has "rubber land scattered all over with this creeper, and there is a large quantity. I feel sure several hundredweights can be harvested, and I hear the market value is 37 cts. per lb. at Kandy. I find Jamaica Sarsaparilla is what is always in the market and no other. I presume it grows wild in Ceylon, as I find it almost growing like a weed."

There is little published information available concerning the growing and curing of this product, probably because its cultivation is limited, the demand

being small. In the report of the Director of the Royal Botanic Gardens, 1889, he says. "The 'Jamaica Sarsaparilla' of commerce is the produce of *Smilax officinalis.* It derived its name 'Jamaica' from being formerly brought from Central America to that island, whence it was exported to Europe. Of this plant next to nothing is known, but a *Smilax* has been cultivated in Jamaica itself for many years, and affords a sarsaparilla which is exported to a small extent. A local nurseryman having recently forwarded a sample grown in Ceylon from plants of this kind imported from Jamaica, attention has been again called to the plant, of which several specimens from Kew are in cultivation at Peradeniya. Sir J. Hooker has expressed his opinion that the cultivated Jamaica sarsaparilla and *S. officinalis* will prove, when their flowers are known, to be different species."

In January, 1890, a sample of Jamaica Sarsaparilla roots grown in Ceylon in pots was submitted to Dr. Trimen, who wrote as follows to the *Ceylon Observer* :— "There are some curious points connected with this product, which has been cultivated in Jamaica for many years past. The plant is not native there, and its geographical origin is not ascertained; nor has it ever been botanically determined with certainty. Moreover, this drug, though certainly a Sarsaparilla from Jamaica, is not the 'Jamaica Sarsaparilla' of commerce. This latter is a product of Central America, and obtained its name in consequence of coming by the way of the West Indian Island. It differs from the kind before us in the dark reddish-brown colour of the root-bark which has very little starch in its structure, or, as it is termed in the trade, is 'non-mealy.' It is this sort that is most sought after by druggists. The sort *grown* in Jamaica is much paler in colour, more starchy ('mealy') and is less valued in the English market. Its cultivation, however, is still carried on there to a considerable extent and is said to be very profitable; the export in 1870 was 1,747 lb., and in 1871, 1,290 lb. I have seen no later returns. I do not think the culture of Sarsaparilla advisable here, at least on any large scale. The reputation of the drug, once very high, has been falling for many years, and by many therapeutists and practitioners it is now regarded as almost if not entirely inert. Careful chemical analysis has not revealed the existence of any alkaloid with important properties, and the use of this once famous tonic is steadily diminishing."

The Jamaica product is still put on the London Market, and the latest market report to hand quotes the following for December "Red native Jamaica obtained 9*d.* to 1*s.* per lb. according to quality." Sarsaparilla is also exported to London from Honduras and Guatemala, but whether this is from cultivated plants or the wild product it is difficult to learn. At the sales referred to above "Honduras was bought in at 1*s.* 3*d.* per lb.," and "ordinary Guatemala at 1*s.* per lb."

Cultivation and Curing.—From a back number of the *Tropical Agriculturist* (1887) we quote the following note :—

In cultivation, the plant is produced from the vine or stem, which is lifted clear from the ground. The soil is then loosened, the vine is buried slightly into it, roots freely, and forms new stock with new roots. Were the plant once established in open scrub land, its nature and habits induce us to believe that it could be made a valuable product with comparatively little trouble. It is also propagated from the seeds, which fall around the parent plant in great numbers, when they fall in loose and rich soil. This seed is enclosed in a fruit or globose envelope, which hangs in branches from the vine like grapes. Each berry encloses a pit of the size of a pea. It turns black upon falling and its envelope is red. Each plant bears twice a year. Sarsaparilla can also be made to root by cuttings. This method is more prompt than by the seed. According to the trials which have been made with it, the roots by this method attain full size in two years; by the seed three years are necessary. Sarsaparilla, cultivated with skill, would give a yield of twice what it does in its wild state. It is estimated that if on the space

of an acre one had a thousand plants, whether from seed, from cuttings, or from sprouts the result would be from four to six thousand pounds of dry sarsaparilla, of the quality most esteemed in commerce. When the roots are ripe they are dug and exposed to the sun until they are quite dry; in some cases the roots are washed before drying. They are then tied up in bundles, weighing from 12 to 20 lb. each for export. The bundles of South America are packed in bales weighing from 80 to 100 lb. or more, and imperfectly covered with skins. In the interior of the bundles are often found roots of inferior quality, rhizomes with adherent stems, stones, chunks of wood, &c. The roots are furnished with a few rootlets. The general colour of the roots is dirty grayish or reddish brown. The cortex is very mealy, and the meditullium or central cord is thinner than in the Jamaica sort.

THE CRUDE CAMPHOR INDUSTRY.

The action of the government in instructing the American Consuls in Japan and Formosa to investigate the crude camphor industry has been the means of bringing the production and marketing of the gum to a more comprehensive appreciation by the many consumers in this country than could probably have been afforded through any other channel of inquiry. The monopoly of crude camphor supplies by the Japanese government and the control of marketing them vested in a London house have combined to thwart the efforts that have been made by many of those interested to a better understanding of the situation. The thoroughness with which the American Consul at Tamsui, Formosa, advises his government opens the field in a manner that serves to leave no point untouched and no detail uncovered......There is one phase of the subject to which reference may be made in this connection, namely, the suggestion that consumers of camphor in this country interest themselves in the possible cultivation of the camphor tree either in this country or in the island possessions where the conditions of climate and soil may be found favorable. We have been advised that attempts have been made to this end in Caliornia and Florida, where the trees seemed to flourish with a prodigality that exceeded that of the Formosa growth, but whether the interest in the experiments was lost during the period of ten to fifteen years required to bring the trees to a profitable development, or whether the trees were permitted to stand for shade or ornamental purposes cannot be stated. At any rate, the result of the experiments, so far as the practical cultivation for the gum is concerned, is not known to have been demonstrated. Since the government's interest has already been enlisted in the subject, the opportunity will be sought to urge that the Bureau of Forestry at Washington be instructed to act on the suggestion of the consul that tests be made of the possiblility of making the camphor tree indigenous to this country or on some of its island possessions. With the variety of soil and climatic conditions within the authority of the government, the practicability of such a venture seems reasonable. Supplementing the information in the consul's report we have the government's statistics of imports of crude camphor to this country during the first ten months of this year (1905), as well as those for the corresponding period of the two previous years, as follows:—

Year.	Quantities. Pounds.	Values.
1905	1,401,087 ...	$489,274
1904	2,247,250 ...	728,319
1903	2,566,778 ...	794,588

The decrease in imports so far this year amounts to 846,163 pounds. while the decrease of last year as compared with 1903 was 319,528 pounds. In the consular report published last week it was estimated that the approximate shortage for this year would be 2,400,000 pounds, and for 1906 between 1,000,000 and 1,500,000 pounds.

Despite the marked disparity between the supply and demand, it will be noted from this week's advices that there is not likely to be an advance in prices for crude next year. The reason that was offered is significant, "that the government does not wish to encourage too deep a research into chemistry for an artificial substitute." Enough stimulus has, however, been afforded to the development of synthetical experimentation by the steadily increasing importance of camphor and the restrictions upon its production and marketing. Several attempts have been made to solve this chemical problem, and new zeal was furnished during the early part of the Japanese-Russian war, when a combination of London manufacturers of celluloid and celluloid goods, the largest field for camphor consumption, offered a prize of $50,000 for the discovery of an acceptable substitute for camphor. Some of the results were triumphs of chemical skill, and the products appeared to possess every characteristic of the natural gum, but none of them was able to stand the supreme test of commercial practicability. The turpentine base seems to have been generally employed in these processes, and the speculative tendency of this market is believed to have proved the chief stumbling block. We are advised that a comparatively new method by a synthesis of a French chemist, but using the turpentine basis, is in successful operation abroad, to the extent of turning out ton lots, and the statement is made that an American plant will be in operation under the same control before June of next year.

THE CONSULAR REPORT.

The following is the report by United States Consul Fisher, of Tamsui, Formosa, which is the most comprehensive review of the camphor industry from a commercial as well as an industrial standpoint that has been published in recent years :—

"On August 5, 1889, the camphor industry of Formosa was placed under governmental monopoly. The chief reason for this action was to increase the revenues of the Government. Other reasons were to raise the standard of quality of camphor manufactured, to regulate the production with regard to future supply, and possibly to save the savage tribes in whose territories practically all of the remaining camphor forests exist. The conditions under which the monopoly has been conducted since it was created, so far as the manufacture of camphor is concerned, are as follows :—

Persons wishing to engage in the manufacture of camphor in the forests are required to obtain permits from the Government. They must furnish an estimate of the amount of camphor they expect to produce during the ensuing year, which must be of a quality not below a certain standard fixed by the Government. All of the camphor, as well as camphor oil, produced must be sold to the Government at prices fixed by it, according to the fineness of the product. Besides accepting deliveries at its main office at Taihoko, the monopoly bureau at first established stations throughout the camphor districts, at which the camphor was accepted from the manufacturers. For camphor delivered at one of the stations a sufficient amount was deducted to cover the cost of transportation to Taihoku, and the loss in weight that would result while in transit.

"Prices and Production.—The schedule of prices for crystalized camphor per picul in yen paid at the different stations was fixed as follows :—

	Crystallized camphor.			Camphor oil.
	First grade.	Second grade.	Third grade.	
Station.	Yen.	Yen.	Yen.	Yen.
Taihoku	30.00 ...	27.00 ...	24·30 ...	15.00
Shinhchiku	29.00 ...	26.10 ...	23.56 ...	14.50
Byoritsu	27.00 ...	24.80 ...	22.30 ...	13.80
Taichu	26.00 ...	23.40 ...	21·10 ...	13·00
Toroku	22.00 ...	19.80 ...	17.80 ...	11.00
Rato	27.50 ...	24.80 ...	22.80 ...	13.80

"In the early part of 1904 a readjustment of the schedule of prices was made, by which it was intended that the Government should stand the cost of transportation from the outlying districts, while the manufacturer would still bear the loss in weight while in transit. Under the schedule then arranged, which is now in vogue, all deliveries were to be made at Taihoku. The prices were fixed as follows per picul:—

	Crystallized camphor.			Camphor oil.
	First grade.	Second grade.	Third grade.	
District.	Yen.	Yen.	Yen.	Yen.
Gilan, Skinko, Toshien, Shinchiku, Byoritsu, Taichu, Nanto and Toroku ...	30.00	27.00	24.30	15.00
Kagi ...	31.00	28.00	25.30	15.50
Banshoryo and Ako ...	32.00	29.00	26.20	15.90
Taito ...	32.70	29.70	27.00	16.30

"One picul equals 133½ pounds. One yen equals $0.498 United States currency.

"The Government supplies to the manufacturers two sizes of canvas bags, one-half picul and one picul, in which the crude camphor is shipped to Taihoku, where, if it is to be exported in its crude form, it is well packed in zinc-lined cases or tubs holding about one picul. The monopoly bureau has a factory at Taihoku for cleaning and pressing such as is to be exported in a semi-refined state, which consists of redistilling and compressing into blocks weighing 10 kin (13½ pounds). Ten of these blocks are packed into a zinc-lined case. A very small proportion of the camphor is marked and turned over to the sole selling agents. Although the Government factory is equipped for extracting camphor from the oil, the most of it is delivered to private refineries in Japan, which, under an arrangement with the monopoly bureau in Formosa, extract the crude camphor and deliver it to the bureau's branch office in Kobe. The oil is supposed to yield about 49 per cent. of crude camphor. The residual oils are used in the manufacture of disinfectants, perfumes, soaps, etc.

"Contract for Sale of the Drug.—As regards the sale of the camphor, the monopoly bureau in the early part of 1900, after inviting tenders from the foreign and Japanese firms desirous of obtaining the sole selling agency, awarded the contract to Messrs. Samuel Samuel & Co., a large British firm, the term of which was for three years, and the general conditions were:—The holder of the agency was to place with the Government a guarantee of 1,900,000 yen, which was permitted to be in the form of Government bonds, bearing interest; he was to conduct the sale of the camphor at London, Hamburg, New York and Hong Kong, and must be prepared to accept from the Government from 20,000 to 50,000 piculs of camphor a year. The Government reserved the right to sell to private persons, other than the sole selling agent, camphor for use of the Government, and also as raw material for the purpose of manufacture in the Japanese Empire. The camphor was to be of two grades—'A' to be known as cleaned and pressed, and 'B,' which is the camphor in its ordinary crude form. So far as possible, the agent was to send such quantities of camphor to the leading markets as would be necessary to supply the demand. The prices to be asked for the drugs abroad were as follows:—For 'A' grade in 10-kin blocks, for London, Hamburg and New York, 107,843 yen per picul,

exclusive of import duties, if any; and for Hong Kong, 102.378 yen. For crude camphor 99.702 yen was to be the price abroad. The Government was to receive from the selling agent 85 yen per picul for the crude and 94.323 yen per picul for the 'A' grade.

"APPEAL TO THE MONOPOLY.—When the monopoly in Formosa was created the camphor industry in Japan had almost ceased to exist, as the trees easily available had been exhausted. With the advanced prices set by the monopoly the manufacturers in Japan found that they could produce camphor from the trees, even though difficult of access, sell it at prices considerably under those of the monopoly, and still realize a good profit, so that the industry there quickly revived. The annual production, which in 1899 amounted to but 1,416,260 pounds, was increased to 2,190,175 pounds in 1900, to 2,669,292 pounds in 1901, and to 3,396,908 pounds in 1902. Moreover, at the time of the enforcement of the monopoly large stocks of camphor were held in Formosa by private persons, with the disposal of which the Government did not interfere. While Japan's production was capable of supplying but a portion of the world's demand, the selling agent found that it would be impossible to maintain the monopoly's original prices and dispose of the whole of the amount stated in their contract. The monopoly was therefore appealed to for a rearrangement of the terms of sale, which was granted. This was in the latter part of 1901. In the meantime the selling agent had acquired large stocks. As the Formosa government had depended upon the profits of the camphor monopoly for a part of its revenue, it was necessary that some steps should be taken to relieve the situation, and with this in view a bill emanating from this Government was submitted to the Imperial Diet in 1902, the object of which was to give the monopoly bureau of Formosa an indirect control over the production and price of the Japanese article. Owing to a technicality the bill did not pass that Diet, but it was plain that some such bill would be passed at its next session. During the season of 1901-2 there was a large production in Japan. The monopoly's prices were forced downward until in June and July crude camphor was sold abroad at 135 shillings per hundredweight (112 pounds), but by August 1 most of the Japanese production had been exported. From that date the monopoly was enabled to raise its prices, and by the end of the year crude camphor stood at 160 shillings abroad. The bureau had during that year reduced its receipts from the manufacturers to nearly 1,200,000 pounds less than those of the preceding year. The next season's (1902-3) production in Japan again forced the monopoly's prices downward. In July, 1903, it delivered crude camphor abroad at 150 shillings. In the meantime the 1903 session of the Imperial Diet had passed a bill placing the industry in Japan under Government monopoly, which was to be enforced from November 1 of that year, and as the largest part of the Japanese production had been disposed of by August, the monopoly's price for crude delivered abroad was raised to 155 shillings per hundredweight during that month. In March of 1904 the price advanced to 162 shillings 6 pence; in September to 166 shillings, and in April, 1905, to 175 shillings, where it stands at present. While the camphor bureau in Japan is independent of the bureau in Formosa, they both exist under one law, and the prices and production are regulated in unison.

"PRODUCTION AND EXPORTATION.—In the summer of 1902 some of the importers of camphor in Europe and America evidently perceived the course that the conditions were shaping and undertook to increase their stocks. The exports of camphor from Formosa and Japan in 1901 amounted to but 6,717,319 pounds; in 1902 they amounted to 9,328,388 pounds; in 1903 to 8,965,568 pounds. In the latter part of 1903 the stocks held by the selling agent had become exhausted, and from that time the demand for crude camphor was compelled to depend for its supply upon the immediate production, which for 1904 was considerably less than the estimates.

The total production in and the total exportations from Formosa and Japan during the years from 1900 to 1904, inclusive, are shown in the table below :—

Year.	Formosa. Pounds.	Japan. Pounds.	Manufactured at Kobe from oil. Pounds.	Total Production. Pounds.	Total Exports. Pounds.
1900	4,511,184	2,190,175	—	6,701,359	6,469,220
1901	4,725,348	2,669,292	1,635,257	9,029,897	6,717,319
1902	3,676,060	3,396,908	1,513,795	8,586,763	9,328,399
1903	4,071,628	2,948,585	1,613,851	9,354,064	8,965,568
1904	4,519,923	900,000	1,979,137	7,399,060	7,392,343

"PRIVILEGES FOR PRIVATE REFINERIES.—At the time of the enforcement of the camphor monopoly in Japan a number of private refineries were in operation there. Instead of taking over their properties and granting compensations, the Government permitted them to continue operation, and arranged to allow them a certain amount of crude camphor, for refining, the product of which they are allowed to dispose of either at home or abroad. I am informed that the amount allowed them is 8,000 piculs, or about 1,067,000 pounds, a year. This is manufactured chiefly into tablets for export. The price at which the crude camphor is turned over to these refineries is not given out, but from figures furnished in the customs returns of Formosa I am led to believe it about 90 yen per picul. At any rate, it is considerably less than the price of crude camphor delivered at New York, minus freight and other charges, and they are enabled to export their products to the United States in competition with the refineries in America. At the expiration of the contract on March 31, 1903, with Messrs. Samuel Samuel & Co., a private agreement was made with the same firm for another period of three years, the terms of which have not been disclosed, but the principal changes made appear to be tnat the prices were to be regulated according to supply and demand. Base prices were to be fixed by the Government, but the selling agent was to be allowed to reduce these prices by not more than 2 shillings per picul. The old arrangement of maintaining the same prices for delivering at London, Berlin, and New York was abolished, so that buyers in New York were allowed the advantage of the lower freight rates to New York than to Europe. After the monopoly was enforced in Japan the selling agent also undertook the disposal of the product there. The present contract will expire on March 31, 1906, but it will probably be renewed with the same firm.

"GRADES AND DISTRIBUTION.—The Government at present puts up three grades of camphor, the 'A' grade which is practically a refined camphor; the 'BB', which is about 97 per cent. pure, and the 'B', which is about 95 per cent. pure. The 'A' constitutes only about 6 per cent. of the total exportation. The proportion of the 'BB' is somewhat larger than that of the 'B.' The American market is supplied almost wholly by the 'B.' In order that camphor might be distributed to the different markets without partiality, the Formosan Government endeavours to apportion the exports to the different countries according to the proportion that each received at the time the monopoly was enforced, which was somewhat as follows: Germany, 37 per cent.; America, 33 per cent.; France, 15 per cent.; Great Britain, 10 per cent.; and India, 5 per cent. Recent investigations as to the supply of camphor trees in Formosa have shown that with the present system of afforestation there is no probability that the material will ever become exhausted, even though the demand for camphor should continue to increase. Vast forests in the south yet remain untouched, and it is now known that the supply in the savage districts of the north is much larger than was at first estimated.

"MANUFACTURE OF CELLULOID.—The question of manufacturing celluloid in Japan has been under consideration for some time, and that industry will probably be undertaken before many years. It appears to me that if such a thing be possible, users of camphor in the United States would find it to their interest to arrange for their future supply by afforestation in localities, either in our island possessions or in the United States, adapted to producing the drug, if they expect to continue their business far into the future. While the camphor industry in Formosa has an advantage in cheap labour, it has disadvantages in the inadequate means of transporting the material from the forests and in the necessity of maintaining a large force of guards for protecting the workmen from attacks by savages, neither of which will be overcome for many years. I am informed that recent experiments in extracting camphor from leaves and twigs of the camphor tree have shown that the drug can be economically produced by that method, and that the monopoly bureau here intends to apply this method as soon as the trees planted a few years ago have reached their seventh year. However, the amount produced in this manner will be a small proportion of the total production.

"The Price of Camphor will not be advanced. From an indirect source I am informed that the Formosan Government does not intend to advance the price of crude camphor during the new year. I am unable to confirm this information, as the Government is naturally reticent in giving out any information regarding prices. With the enormous shortage in the present supply, it would appear that an advance of say 10 shillings per picul could easily be maintained, and the only reason why such an advance might not be made is that the Government does not wish to encourage too deep a research into chemistry for an artificial substitute. Without being able to secure direct information, I am inclined to credit the information at hand that the price will not be materially advanced during the next year. The present price of the 'B' grade, cost, insurance, and freight, New York, is 175 shillings per hundredweight of 112 pounds, or 100 yen per picul. The direct cost (not including maintenance of the camphor bureau) to the Government of this grade, delivered to the selling agent, is about 35 yen per picul."

THE TOBACCO INDUSTRY OF CEYLON.

The tobacco industry of Ceylon, there is no reason to doubt, will attain to important proportions if properly developed. As people in the country are aware, various descriptions of leaf are produced in different parts of the Island where soil and climatic conditions vary—in Jaffna, the arid Vanni and Kurunegala; Kandy, Dumbara and Hewaheta in the hill country; Negombo and other places on the sea coast in the west; and Trincomalee in the east—tobaccos of varying flavour and strength, for smoking and chewing, all of which find a good and ready local market. The production is large as those who have travelled about the country could testify, and notwithstanding the supply, enormous quantities of tobacco for smoking purposes are imported annually into the Island. Looking into the latest Customs Returns, issued by the Principal Collector of Customs, we see that from January to November last, eleven months, we expended so large a sum as 3¼ lakhs of rupees in this direction, importing 172,702 lbs. of tobacco of the value of Rs. 326,439. Of this 122,720 lbs. of tobacco, of the value of Rs. 288,678, represented cigars, and 49,982 lbs. valued at Rs. 37,761, represented unmanufactured tobaccos. Of the manufactured article 48,199 lbs. value Rs. 36,149 came from India, and 1,569 lbs. value Rs. 1,470 from Egypt. This tobacco is used in the manufacture of cheap, light cigars and cigarettes. Our readers will be familiar with the itinerant South Indian trader who visits our bungalows armed with cigars of

curious brands made up in their wooden boxes of local manufacture. These cigars are turned out in the Pettah by traders who import cheap leaf from South India, and a large number of these cigars are also disposed of among the shipping in harbour. The cigars are of a poor description, and are used locally by those who prefer a light smoke at a cheap cost. The taste for light tobacco is undoubtedly being developed among the people of the country in place of the crude and strong smoke provided in the Jaffna tobacco cigar; and there is no reason why cheap light cigars could not be manufactured from locally grown leaf to supply this growing demand for a light tobacco smoke.

Turning however to our cigar bill for the year the 122,000 odd lbs., costing nearly 3 lakhs of rupees, were supplied during the 11 months ended November last, for home consumption, by the following countries:—

	Total quantities.	Value.
	lbs.	Rs.
United Kingdom	101,336	223,440
British India	5,862	11,725
Holland	4,793	17,171
Philippine Islands	3,731	8,750
United States	2,622	8,320
Egypt	1,802	9,950
Germany	1,468	5,157
China	371	1,160
Malta	185	885
Belgium	165	240
Spain	115	758
Aden	99	542
Hongkong	95	403
Burma	65	90
Straits Settlements	15	68
France	6	17
Total	122,720	288,676

It will strike one as strange that a tobacco growing country like Ceylon with its varying soil and climatic conditions, where tobacco of varying flavours could be grown, should expend nearly four lakhs of rupees a year on foreign tobaccos. Some of the brands of cigars imported are no doubt unrivalled, but Ceylon could undoubtedly produce cigars to equal a large proportion of those imported from countries enumerated above. There is then scope for a larger, local market, not to mention the exportation of cigars of a guaranteed quality. Turning now to the export of a local grown tobacco from the Island, we note that during the eleven months ended November last manufactured tobacco to the extent of 3,908,503, lbs., of the value of Rs. 835,998 were exported from the Island, of which, with the exception of 24 lbs. valued at Rs. 15 sent to Burma and the Straits, the rest were shipped to India. No cigars of local manufacture were exported. The local Agricultural Society will undoubtedly have much material to work upon in connection with the proposal to investigate the question of the tobacco production of the Island.—*Ceylon Independent.*

THE BRITISH-AMERICAN TOBACCO COMPANY (CEYLON), LIMITED.

Registered November 30th. Capital, £10,000 in £1 shares. Objects, to carry on in Ceylon or elsewhere the business of tobacco growers, manufacturers and merchants, manufacturers of, and dealers in, cigars, cigarettes and snuff, general merchants, agents and indent brokers, &c., provided that the Company may not, without the consent of the British-American Tobacco Company, Limited, (*a*) carry on any of the said businesses outside Ceylon; (*b*) cultivate, manipulate or deal in leaf tobacco in Ceylon; (*c*) manufacture tobacco or its products in Ceylon; (*d*) export tobacco or its products from Ceylon; or (*e*) be interested in any other business connected with the manufacture or sale of tobacco and its products. No initial public issue. The first directors (to number not less than three or more than nine) are W. R. Harris, W. B. Ogden, H. von R. Cunliffe-Owen, T. Gracey, J. Hood, L. Hignett, A. C. Churchman, and A. G. Jeffress, with one other to be appointed by them. Qualification, one share. No remuneration. Registered office, Cecil Chambers, 86, Strand, London W.C.

EDIBLE PRODUCTS.

Macadamia Ternifolia, F. M., or "Queensland Nut."

A NUT TREE SUITED TO CEYLON.

By H. F. Macmillan.

The Queensland Nut is well worthy of cultivation in Ceylon, not only as an ornamental or windbelt-tree, but also for its dainty product. That it is suited to our climate may be judged from the growth of the tree at Peradeniya, where, having been introduced in 1868, it is now 40 to 50 feet high, with a spreading habit. It is indigenous to the north-eastern parts of Australia, and is commonly known there as the "Queensland Nut." It has also been referred to as the "Australian Hazel-nut," whilst the late Baron von Mueller described it as "The nut tree of sub-tropical Eastern Australia." The tree is at first of a rather slow growing habit, but begins to bear fruit when six or seven years old, increasing in fertility till it reaches an age of 15 years.

A writer in the "Sydney Mail" some time ago stated that the tree fruited freely from the time it was eight years old, bearing at the age of thirteen 1,200 nuts, with which every branch was laden. Mr. W. J. Allen, in the *Agricultural Gazette* of N. S. Wales for October of last year, draws attention to the importance of growing the Queensland Nut for the market. One farmer, he states, "has over an acre of these nuts, which are doing well with him, and which prove themselves very profitable, finding ready sale for them at from 6*d.* to 7*d.* per lb. The nuts are retailed in the Sydney fruit shops at 1*s.* per lb., and are very well liked when they become known. At present the supply in our own State cannot be anything like equal to the demand, and it seems to me that if these nuts were produced in quantities, we should be able to find a ready sale for large supplies in Great Britain and America." Mr. Allen describes the nut as "one of the best flavoured on the market," and he would recommend all those who have not tasted them to buy a few and try them.

The nuts are borne on spikes 4 to 7 inches long, each being of the size and shape of large marbles, about ¾ of an inch in diameter. These have an agreeable flavour, which according to some tastes is richer than that of the Hazel-nut. Their chief objection is, perhaps, their very hard shell, which requires extra strong nut crackers to break. A wag has suggested that this explains the derivation of the name "Macadam," having reference to the inventor of the system of road-making of that name. The tree, however, has been named in honour of Dr. Macadam, a scientist of Victoria.

The tree belongs to the order of *Protœceae*, to which belongs also the well-known *Grevillea* or "Silky Oak." It is evergreen, with a low branching habit; thrives best in good deep soil, and is propagated by seed. The leaves are in whorls of 3 (ternate) or 4, as the name indicates, and the flowers are creamy white, in racemes 4 to 6 inches in length, and sweet-scented.

It is not generally known how largely nuts of different kinds figure in the list of commercial fruits and food products of the world. Some nuts afford a very wholesome diet, as for example Chestnuts, which, being made into flour, are a standard article of food in some districts of Southern France and Italy, whence, it is said, 30,000,000 bushels are exported to England and America every year. In Spain and elsewhere the cultivation and export of Hazel nuts form a considerable industry, whilst the Pecan, Hickory, and Walnuts are all largely cultivated and of

considerable commercial importance in Europe and the United States. Brazil Nuts and Butter Nuts form an export from South America amounting to close on 8,000 tons a year, and the demand for these is only limited by the supply. Pistachio nuts are a favourite delicacy, and are largely eaten by the Turks and Greeks, being also, according to Rev. Firminger "obtainable in great abundance in the cold weather in the bazaars of most parts of India." These are not, however, produced in India, but probably in Asiatic Turkey, whence about 1,300 cwts. are yearly imported by England alone.

Authorities on the subject claim that nuts, especially the larger and mor important kinds, are a nutritious and wholesome food, and predict that the time may come when they will form one of the staples of human food. Vegetarians generally advocate extended cultivation of the better kinds of nuts; these may be cooked and prepared into numerous dainty dishes, which are claimed to be good substitutes for flesh food.

THE ECONOMIC POSSIBILITIES OF THE INDIAN JACK.

The common Jack (*Artocarpus integrifolia*, Linn.) is so familiar a tree of the Indian Garden that a description of it would appear to be superfluous. Its evergreen crown of dark, glossy leaves, its stout low-branched trunk as well as the irregular branches themselves together with the enormous pendulous syncarpia that are, for the most part, borne upon the stem are too well-known for special remark. It is, however, open to question as to whether the possibilities that are realizable from the utilization of its fruits on any large scale have hitherto engaged the attention they merit at the hands of the Indian agriculturist or economist. For in this "age of economists and calculators" due regard is seldom had or taken of the valuable source of economic starch. Though the presence of large quantities of the butyrate of ethyl in the fleshy arils of the fruits, when ripe, lends them an odour and flavour that are admitted to be distinctly repugnant to European tastes, they are eagerly sought after and consumed by the natives whenever and wherever they are available. The unripe flakes, together with the nuts or seeds, are boiled and eaten or cooked in curries. Throughout the West Coast of India and in Lower Burma it is the fruit of the hot weather.

Besides the farinaceous arils surrounding the seeds, the latter themselves are nothing less than compact masses of nutritious starch. These arils, with the seeds enveloped in them, constitute the real fruit of the plant and are, by far, its most valuable product. As stores of readily-available starch they are especially of importance to the people of India, particularly during seasons of scarcity and distress. For, either product separated from the other or the two combined together when converted into chips and dried in the sun, admit of being transported to distant places and stored up for indefinite periods of time. When the syncarpia mature, the flakes are separable from the common stalk on which they are borne. The arils may then be readily sliced up with or without the seeds inside them and the slices spread out upon mats and dried in the sun until they are brittle. When they are dry, one or a couple of winnowings is all that will be necessary to eliminate the chips from the dense and indigestible testas of the seeds as well as from any other undesirable matter that may have got mixed up with the chips during their exposure to the sun. Or, after peeling the flakes, the arils may be dried apart from the seeds and the latter desiccated and reduced to flour by pounding in the ordinary mortars of the country. When required for use, the product, on being boiled, in water seasoned with salt, resolves into a mealy mess or porridge spoken of in high terms by the indigent consumer. The mature seeds, when roasted or boiled, resemble the common

chestnut in flavour, while the flour to which they are reducible, when dry, is not unlike that of the Zingara nut (*Trapa bispinosa*). A single frutescence of average size is capable of yielding about 2 pounds of the chips as well as one pound of the seed-flour. The average annual yield of the tree may safely be estimated at 20 Jacks; so that an acre stocked with about 50 trees, standing 30 feet apart each way, would produce 50×20 by 3 or 3,000 pounds of the farinaceous material.

The cultivation of the Jack which has been practised for ages in the hills and plains and gardens of India still admits of much profitable expansion. The vast stretches of waste land that are still available, in the moister regions of the Empire especially, could be easily redeemed from unprofitable jungle and made to efficiently minister to the necessities of agriculture. The cereals that furnish the staple crops of India frequently prove extremely precarious, and the consequent cry for food, when they fail, is usually difficult to adequately appease. The salvation of the situation apparently lies in the direction indicated by the establishment and maintenance of extensive farms raising farinaceous and other products that do not depend, like the majority of the cereals, upon the degree of seasonable moisture in a locality. Trees and plants that develope ligneous tissue can ordinarily withstand with greater impunity the nefarious effects of unfavourable agricultural seasons. Again, the national economic influences that can advantageously be exerted by extensive estates of woody species which, at the same time, produce abundance of food, cannot be too highly extolled in a country which has long since become a prey to periodic famines. The ease with which the jack could be grown upon almost sterile soils is a point of vast practical importance in favour of its extended cultivation in India. It is seemingly indifferent to most soils provided they are well drained and not too hard or stony. It thrives upon laterite, red-earth and sand as well upon a variety of soils that are classifiable as intermediate forms between these. It is capable of withstanding a high summer temperature but does not thrive in extremes of climate. The young crop requires to be watered during the hot weather of the year following its installation, and the plants during that and the succeeding year protected against ravages of cattle and fire. In its third year it will ordinarily attain to a height which will be well beyond the reach of cattle, and will also be sufficiently lignified to withstand the ravages of fire with considerable impunity.

The species bears fruits for the first time after the fifth or sixth year of its age; but does not, in most localities attain to profitable frutescence until the completion of its tenth year. It thereafter bears, in increasing qualities, until the limit of its innate vigour is attained after which the yield begins to decline. Jack trees in Malabar have been known to yield, year after year, without symptoms of decline for periods of fifty years or more; while it is difficult to estimate with any degree of accuracy the age, doubtless great, of individuals of the species that sporadically occur in the forests of the Western Ghats.—*Capital.*

THE AVOCADO: A SALAD FRUIT FROM THE TROPICS.

Introduction.

As our contact with the Tropics becomes more and more intimate, and transportation facilities are improved, the number of fresh food products received from tropical countries is rapidly increasing. Among the most promising of such articles is the avocado, still little known, but rapidly increasing in favour. The avocado, though technically a fruit and usually referred to as such, is from the culinary standpoint no more a fruit than the cucumber. It is more accurately described by the term "salad fruit," and may be said to stand alone as the only fruit that when ripe is eaten almost exclusively as a salad. The nearest approach to this is perhaps the olive, which is eaten more as a relish. This unexpected rôle

no doubt accounts to a large extent for the dislike or indifference often professed by persons tasting the avocado for the first time. As in the case of the olive, where the novice usually describes the fruit as an insipid pickle, the appearance of the avocado leads one to expect a sweet or acid fruit, and the more or less unconscious disappointment usually leads the experimenter to pronounce the avocado tasteless and oily. One writer describes it as having a "taste not much like that of our pears (the avocado is often called 'alligator pear'), and in first trying to eat the fruit one may pronounce it a poor pear but a good kind of pumpkin," and adds the charitable suggestion that "cooking or preserving may bring out the hidden virtues."

Few persons who live for any length of time in countries where avocados are to be had fail to acquire a taste for this delicious salad fruit. It is the rule, however, that the taste for an entirely new article of diet has to be cultivated, and a food which was unknown to our fathers, and which we meet for the first time after our tastes have been formed is seldom accepted at the first trial. In most cases it is only after repeated attempts, prompted usually by the assurances of the initiated, that a fondness for the strange article begins to grow. The human taste is, however, fairly uniform, and a liking for any food that is popular in its native country is usually acquired by the stranger if his first attempts do not create a prejudice so strong as to prevent further experiments. As examples of foods that when first tried outside of their native country were by most people either disliked or considered insipid, but which have since become firmly established may be mentioned olives, bananas, artichokes, chocolate, tomatoes, curries, and peppers. With avocados the taste is usually acquired after two or three attempts, and many profess a fondness for the fruit at the first trial. That the taste when once acquired amounts almost to a craving is attested by prices paid for the fruit in the northern markets, where 15 cents each is about the lowest figure at which they can be bought, and good fruit usually sells as high as 30 cents, though 50 or 60 cents is not an uncommon price. The avocado may thus be said to have taken the first steps along the lines by which most foreign fruits have been successfully introduced. An early impetus was received when the fruit was served on the tables of the rich and fashionable, its intrinsic merit being aided, without doubt, by the desire to inaugurate a novelty at once rare and expensive. The tendency to imitate this use assisted in increasing the demand until the fashionable hotels were able to score a point by adding the fruit to their menus. From this stage to that of introduction into the markets and fruit stores, where the general public will make its acquaintance, is, perhaps, the slowest and most crucial step in the history of a successful new product, and one that the avocado is at present undergoing.

ORIGIN AND HISTORY: EARLY ACCOUNTS.

What appears to be the earliest reference to the avocado is found in Oviedo's report to Charles V. of Spain, in the year 1526, a translation of which follows:—

On the mainland are certain trees that are called pear trees (perales). They are not pear trees like those of Spain, but are held in no less esteem; rather does this fruit have many advantages over the pears of that country. These are certain large trees, with long narrow leaves similar to the laurel, but larger and more green. This tree produces certain pears, many of which weigh more than a pound, and some less, but usually a pound, a little more or less ; and the colour and shape is that of true pears, and the skin is somewhat thicker, but softer, and in the middle it holds a seed like a peeled chestnut ; but it is very bitter, as was said farther back of the mammee, except that here it is of one piece and in the mammee of three, but it is similarly bitter and of the same form ; and over this seed is a delicate membrane, and between it and the primary skin is that which is eaten,

which is something of a liquid or paste that is very similar to butter and a very good food and of good flavour, and such that those that can have them guard and appreciate them; and they are wild trees in the manner of all those that have been spoken of, for the chief gardener is God, and the Indians apply no work whatever to these trees. With cheese these pears taste very well, and they are gathered early, before they are ripe, and stored; and after they are collected they mature and become in perfect condition to be eaten; but after they are ready to be eaten they spoil if they are left and allowed to pass that time.

COMMON NAMES.

The various common names of the avocado form a curious and undignified jumble. None seems to be available that is not either misleading in its application or difficult to pronounce. The most common designation among English-speaking people is "alligator pear," and, although it is very difficult and for many reasons undesirable to change a popular name, it seems best while this fruit is still little known to endeavour to secure a less misleading designation. The name "avocado" is almost as widely used as "alligator pear," and while not altogether unobjectionable, its adoption will avoid the confusion of this salad fruit with varieties of the common pear. The use of the name "alligator pear" not only retards the true appreciation of this very distinct article of diet, but will eventually cause annoying complications in statistical classifications of the products of regions where both this and true pears are grown. The word "pear" is sometimes appended to "avocado," and the name is then no less objectionable than the other form. "Palta" is applied to the avocado in Chile, Peru, and Ecuador, and is said by Garcilasso de la Vega to have been applied by the Incas, who brought this fruit from the province of that name to the warm valley of Cuzco, although it seems not improbable that the province may have received its name from the tree, according to the common custom of primitive people.

The name "ahuacaquahuitl," given by Hernandez, signifies "like the oak tree," and is variously spelled by other writers. The words "aguacate' and "avocado" are probably Spanish spellings of attempts to pronounce the Aztec name. To an Andalusian the sound of the word would naturally suggest the spelling "aguacate," while a Castilian would be more likely to adopt the other form. The French name "avocat" is probably a modification of the Spanish, or perhaps an independent approximation of the native name. The tendency to transform a new name into a word already existing in the language is shown in the spelling "abogado" in the Spanish and "avocat" in the French, both words meaning lawyer. Tussac gives "aoucate" as the Carib name and derives the French "avocat" from that form. Jumelle and Pickering also give modifications of this word as Carib. It seems impossible that the Carib and Aztec names should be so similar, and it is more likely that the Carib's attempt to pronounce the Spansh designation was erroneously recorded as a native name.

The form of the fruit obviously suggests the term "pear," and "perales," or pear trees, was the name under which they were first recorded by Oviedo in 1526, that author, however, stating that they were pears in form and in nothing else. The name "alligator" is entirely without warrant, and no one has as yet suggested even a fanciful application to any of the characteristics of the fruit or tree. It has been suggested that the term is a further corruption of the Spanish "aguacate," and this must be admitted as possible. The occurrence of the word "alligator" prefixed to the names of plants, such as "alligator pepper" for *Amomum melegueta*, Rosc., suggests that the word may formerly have been used to signify false or worthless, and if this were true its application to this pear-shaped fruit would be very natural. The application of other English names, such as "subaltern's butter," "midshipman's butter," "vegetable marrow," etc., is obvious.

DISTRIBUTION.

Many general works on tropical agriculture refer to the avocado as a native of the West Indies. There seems, however, to be no positive warrant for this, while there are many indications to the contrary. The avocado has, since the time of Columbus, spread from its home in America entirely around the Tropics. That such an important food plant was confined to the American continent until the post-Columbian contact with the Old World, while numerous other plants, such as the yam, taro, and sweet potato, had already spread to parts of the Old World, was probably due to the fact that the avocado will not easily survive long voyages, while most of the tropical root crops have much greater vitality. The fruit spread but slowly before the last century, but in recent times its culture has rapidly increased, and it is now cultivated in most of the countries that are suited to its growth. It has been cultivated in India since about 1860, and has reached the Islands of Madagascar, Reunion, Madeira, the Canaries, Samoa, and Tahiti. In Natal and Australia it is just gaining a foothold. Its cultivation is increasing in Algiers. In 1882 it was reported as growing in southern France along the shores of the Mediterranean. Some of the trees had flowered, but apparently none had fruited at that time. In southern Spain, however, the tree fruits, and is cultivated to a limited extent. E. Roul gives the range of this species as 36° from the equator. He states, however, that certain varieties, such as "dulce," are not found outside the Tropics. The avocado seems to have commanded very little attention in the West Indies. No mention is made of this fruit in Morris's account of the British West Indies, and the index to the bulletins of the botanical department of Jamaica does not contain a single reference to it. In Porto Rico the fruit is abundant and popular, although not so important a staple as in tropical Mexico, where quantities of even the most inferior fruit are consumed by the natives, who consider it an important ingredient of that indispensable Spanish dish, soup. There are now orchards of avocados in southern Florida and California, and a slightly harder variety would greatly extend the culture of this fruit in these regions. Cuban fruit is shipped to the northern markets, and the conditions in that island are probably similar to those existing in Porto Rico. In the tropical parts of Mexico, Central America, and South America the fruit is very common, and its different forms and races are innumerable.

DESCRIPTION.

The avocado tree is 20 to 60 feet high, varying in habit from tall and rather strict to short and spreading. In favourable situations the top is very dense. The leaves are 20 to 40 cm. long and 7 to 25 cm. wide acuminate at the apex, varying from acute to truncate at base, petiole 2 to 8 cm. long. The upper surface is smooth, with depressed veins; the lower surface is glaucous, with the raised veins slightly pubescent. Different forms, all referred to the one species, vary so greatly in the form and size of the leaves that close relationship would hardly be suspected. Climatic differences may possibly account for some of this variation, the large, broad-leaved forms being usually found near the coast. Young trees have also, as a rule, much larger leaves.

THE FLOWERS are perfect and are borne on loose axillary racemes near the ends of the branches, usually at the base of the year's growth. The corolla is wanting, the calyx 6-parted. The lobes are all of equal length, green in color, and pubescent. The stamens are 9, in three series; the anthers 4-celled, opening by valves hinged distally. The two outer series have the openings introrsely directed; the inner series has the two distal valves introrsely, the basal pair extrorsely, directed. Each stamen of the inner series bears near its base two large glands. Inside the stamens are three staminoidia. Occasionally 4-parted flowers are to be found, in which case they are 4-parted throughout. The ovary is 1-celled, the style simple.

The Fruit in some varieties is long and slender; in others, nearly globular, varying from 3 to 15 cm. (1 to 6 inches) in diameter. The outside covering in some forms is soft and pliable, often less than one-half millimeter in thickness, while in others it is hard and granular, in some of the Central American forms reaching 3 mm. in thickness. The fleshy part of the fruit between the skin and the seed varies greatly in thickness, but is always butyraceous in consistency, though in some cases much firmer than in others. In the better varieties the fibrovascular system that enters the fruit from the stem is discernible only in the thin flesh in the very base of the fruit and at the base of the seed, which is toward the apical end of the fruit. The seed thus appears to receive its nourishment directly from the pulp by absorption or ceases to receive nourishment before the fruit is fully formed. In the coarser forms the bundles can be traced from the stem throughout the pulp to the point where they enter the seed, and in some cases they are so prominent that the quality of the fruit is seriously impaired. The tree is usually described as evergreen. In some localities, however, the leaves are dropped just before flowering, leaving the tree naked for a short time. This is the case in Alta Vera Paz, Guatemala, where a type with narrow leaves and very thick-skinned fruit prevails. Whether this deciduous character is peculiar to the variety or the result of climatic conditions could not be determined.

The Seed is single, inverted, exalbuminous, spherical, or pointed, provided with two more or less distinct coats, one or both of which may adhere very closely to the cotyledons, though usually separable at the base of the seed; or they may adhere to the flesh of the fruit and separate from the cotyledons. This latter condition is observed more commonly in specimens not fully matured. The surface of the outer coverings may be coarsely reticulated or granular. The seed coats are frequently produced into a point beyond the apex of the cotyledons. The cotyledons are nearly hemispherical in form, white or light green in colour. The surface of some forms is smooth; in others rugose. The plumule is well developed before the fruit ripens and is located from 10 to 15 mm. from base of seed. Concerning the seedling, Holm has pointed out that no hypocotyl develops. He also calls attention to the curious fact that the first four leaves are opposite, and by showing a differentiation into petiole and blade more closely resemble the mature leaf than do the following five or six leaves, which are almost scalelike.

BOTANICAL AFFINITIES.

The genus *Persea*, to which the avocado belongs, is a member of the family *Lauraceæ*. Among the other more important economic members of the family are cinnamon (*Cinnamomum cinnamomum* (L.) Cockerell), camphor (*Cinnamomum camphora* (L.) Nees), and sassafras (*Sassafras sassafras* (L.) Karst.). With the exception of cinnamon, they are used chiefly in medicine. The avocado is the only member of the family cultivated for its edible fruit. Mez, in his monograph of the family, describes forty-seven species of Persea, and states that the genus is confined to the American continent, with the exception of one species in the Canary Islands. On the contrary, F. Pax restricts the genus to ten species.

VARIETIES.

The botanical descriptions of varieties of the avocado are in nearly every case too meagre and too general in their terms to be recognized, and are in every case based on floral and leaf characters, no mention being made of the fruit. Meissner describes four varieties, as follows:—

Var. *vulgaris*. Leaves medium sized, mostly 3 to 4 inches long, 1½ inches broad, oval or obovate; flowers short pediceled. West Indies, Central and South America.

Var. *oblonga*. Leaves long, equally attenuate at both ends, often acute, 4 to 9 inches long, 1¼ to 2 inches wide, short pediceled. West Indies, Mexico, Peru, Brazil, Mascarene Islands, Java.

Var. *marcophylla*. Leaves larger, 6 to 9 inches long, 3 to 4½ inches broad, obovate or obovate-oblong, acutely acuminate, short pediceled. Eastern Peru, British Guiana, Central America, Mexico.

Var. *schiedeana*, Leaves ample, 9 inches and more in length, 3 to 4½ inches broad, obovate and oblong, acute or obtuse, young leaves with a thick yellow tomentum, veins and veinules rather accentuated underneath, panicles terminal, bases with long persistent imbricate bracts, pedicels rather long. Misantla, Mexico. Mez recognizes two varieties as differing from the normal type, one of which is the *schiedeana* described above, and which is apparently confined to Mexico; the other, *drimyfolia*, also confined to Mexico, was formerly considered a distinct species. A translation of his description of the latter variety is as follows:—

Variety *drimyfolia*. Differs from the normal form in being smoother; leaves oblong-lanceolate, narrowly acute at base, apex acute or somewhat acute, below glaucous.

A delicious fruit tree, cultivated in tropical regions, and from thence imported into Europe. In Portugal and Sicily it winters if protected, and sometimes produces mature fruit. Embryo (according to Schomburg) often with three cotyledons, and frequently germinating on the tree. According to Krug, the fruits of this tree come true to seed, and it is not necessary to graft. This description applies best to the hard-skinned type of Guatemala, the peculiarities of the fruit of which seem never to have found their way into literature, and it is probable that the similarity is confined merely to the dimensions of the leaves. The marked differences in the fruits of the avocados from different localities are recognizable in the earliest descriptions. Hernandez's description of a black fruit, the size and shape of an egg or fig corresponds well with many of the small black forms grown in Mexico at the present time, and, so far as known, not occurring elsewhere. On the other hand, all the early writers on the West Indies describe a much larger fruit with much thicker flesh.

The distinction between the thick-skinned and thin-skinned forms of the avocados was made as early as 1590 by Acosta, who wrote:—The Palta is a great tree, and carries a faire leafe, which hath a fruit like to great peares: within it hath a great stone, and all the rest is soft meate, so as when they are full ripe, they are, as it were, butter, and have a delicate taste. In Peru the Paltas are great, and have a very hard skale, which may be taken off whole. The fruit is most usual in Mexico, having a thinne skinne, which may be peeled like an apple; they hold it for a holesome meate, and, as I have said, it declines a little from heat.

It is worthy of note that the earliest account of the avocado in the West Indies, by Hughes, describes a hard-skinned type, yet so far as known this type does not exist in the West Indies at the present time. The description referred to follows:—This is a reasonable high and well-spread Tree, whose leaves are smooth and of a pale green colour: the Fruit is of the fashion of a Fig, but very smooth on the outside, and as big in bulk as a Slipper-Pear; of a brown colour, having a stone in the middle as big as an Apricot, but round, hard and smooth; the outer paring or rinde is, as it were, a kinde of a shell, almost like an Acorn-shell, but not altogether so tough; yet the middle substance (I mean between the stone and the paring, or outer crusty rine) is very soft and tender, almost as soft as the pulp of a Pippin not over-roasted. It groweth in divers places in Jamaica; and the truth is, I never saw it elsewhere; but it is possible it may be in other Islands adjacent, which are not much different in Latitude. I never

heard it called by any other name than the Spanish Pear, or by some the Shell-Pear; and I suppose it is so called only by the English (knowing no other name for it) because it was there planted by Spaniards before our countrymen had any being there; or else because it hath a kinde of shell or crusty out-side. I think it to be one of the most rare and most pleasant Fruits in that Island; it nourisheth and strengtheneth the body, corroborating the vital spirits, and procuring lust exceedingly: the Pulp being taken out and macerated in some convenient thing, and eaten with a little Vinegar and Pepper, or several other ways, is very delicious meat.

GEOGRAPHICAL TYPES.

In nearly all parts of the American Tropics there is a great variety in the forms of the avocado, yet comparatively few have received distinctive names, and only a very few have found their way into literature. In the "Revue Horticole," 1900, page 546, D. Bois describes nine Mexican varieties as follows:—

Dulce largo, green, in form of a gourd, with a long neck; seed large.
De tecosautla, dark green, with ovoid seed.
Pagua, large, spherical, purple in colour, with a large seed.
Morado de Chalco, pear-shaped, purplish.
Dulce, large, green, oblong, with whitish, ovoid seed.
Pagua redonda, round, green, with a very large reddish seed.
Verde de San Angel, light purplish, pear-shaped.
Morado de San Angel, light purple; seed ovoid.
Verde chico, small, green, with an elliptical seed.

These same varieties appear in slightly different form in Sagot's "Manuel Pratique des Cultures Tropicales," page 157.

Sagra mentions four forms from Cuba, as follows:—

Violet, almost round.
Thick green, round, with yellowish flesh of a spongy consistency.
Long yellow, similar to a large pear.
Long green.

There is little to be gained in attempting to identify these forms, as none of the characteristics of economic importance are mentioned, and from observations made in Mexico it appears probable that these forms merge into one another with many imperceptible gradations. The author has had the opportunity of studying avocados in Porto Rico, Guatemala, Costa Rica, and Mexico; and from the fruit that has come under observation the avocados of Mexico, while diverse in form and color, seem to be much more closely related to each other than to those of any other of the above-mentioned countries. As much of the fruit was obtained in markets, it was often impossible to determine the character of the tree on which any particular fruit was borne, and in no case could floral and fruit characters be compared. Aside from yield, vigour, and hardiness, the more important characteristics of a variety, from a commercial standpoint, can be determined from the fruit alone.

In a general way each of the countries visited exhibited distinct types of avocados, although in nearly every case aberrant forms occur which frequently seem to be associated with the types of other countries. In many such cases the resemblance is probably a similarity in formal characters rather than a true relationship. In making the following descriptions, several new characters have been used, such as the nature of the skin, whether it is hard or soft, thick or thin, and the character of the seed coats, believing that these are of more importance than the form and color by which the cultivated varieties have usually been distinguished. Until more complete botanical studies have been made it seems advisable in describing the different forms to take

them up by countries. The names applied to the different forms are merely to facilitate reference. It seems a curious fact that although the avocado has a great variety of names in different countries the different forms in any particular locality rarely receive distinctive appellations. Thus in Porto Rico, where mangoes that to the casual observer appear identical are carefully distinguished and provided with particular names, the many varied forms of avocados are all called "aguacate" without further distinction. In Mexico also, where the variety is still greater, no names for the different forms could be elicited from those selling the fruits in the markets, although the qualities of the different forms were keenly appreciated and willingly pointed out.

As might be expected, there are several countries that claim to produce the finest avocados, among which may be mentioned Colombia, Hawaii, Peru, and Brazil. According to travellers familiar with the Pacific coast of tropical America, the largest and finest avocados come from the vicinity of Tamaco, in Colombia. These are said to be much larger than those of the Central American coast and of equally fine flavour. In Brazil the finest fruits are said to come from the islands of Marajo, at the mouth of the Amazon. As with most fruits, the largest and fairest are not always the best flavoured. The delicate nutty flavour of some of the small thin-fleshed kinds of Guatemala is seldom equalled in the large thick-fleshed varieties.

GUATEMALA.—The avocados of Guatemala form a very distinct group. They are at once the most marked and, from a commercial standpoint, the most promising type for introduction into our tropical possessions. The most peculiar characteristic of the Guatemalan avocados is the unusual texture of the skin. Unlike the Mexican and West Indian types, which are usually found in our northern markets, the Guatemalan fruit is covered with a skin so thick and unyielding that it suggests the shell of a nut. If pressed inward with the finger, instead of bending or tearing, the skin breaks with a granular fracture. To judge from Acosta's account, the avocados of Peru have a skin similar to those in Guatemala, though, curiously enough in Costa Rica, midway between these two countries, not a single hard-skinned form was observed. In all the Guatemalan varieties the seed coats adhere closely to each other and to the cotyledons over nearly the entire surface. In this respect they resemble the Mexican and differ from the Cuban and Porto Rican forms, which have the seed coats distinct from each other, the outer coat usually adhering to the flesh. The flesh of the Guatemalan forms frequently contains objectionable fibres, but in many cases it is entirely fibreless. In every case the line of division between the flesh and the skin is distinct, and the flesh can be scooped out with a spoon and the skin scraped, agreeing in this regard with the Cuban forms and differing from those of Mexico and Porto Rico, where there is no marked line between the flesh and the skin, and where, if care be not taken in using the spoon, portions of the skin are taken up with the flesh. Fruit of this type is borne on the tall, spreading tree common in Guatemala. The leaves are narrower and longer than in the West Indian type, about 23 cm. (including the petiole, which is about 2·5 cm.) by 7·5 cm. wide, acuminate at the apex, tapering at the base. Leaves smooth above, with depressed veins; below, the veins are prominent, with numerous fine hairs, and the surface is glaucous, with scattered fine hairs. Although in a general way belonging to one type, the avocados of Guatemala that came under the writer's observation can be separated into three forms capable of more or less definite delimitation. Thick-skinned round.—This is the most common type in the eastern part of Guatemala. There is great diversity in size and quality among the specimens included under this form, and some of those found at Guatemala City appear to be distinct, but they are not easily separated by

formal characters. Form nearly spherical: colour varying from dark green to dark brown or nearly black; skin hard and unyielding, breaking rather than tearing, never less than 2 mm. in thickness, granular in texture; flesh distinctly differentiated from the skin, often separated from it when fully ripe; seed as broad as or broader than long, rounded at the apex. The two seed coats are so united as to be indistinguishable, and when fully ripe adhere closely to the seed, except at a small area near the base. When the green fruit is opened the seed coats often leave the seeds and adhere to the flesh, The better specimens of this and the following form are probably the most promising for introduction into Porto Rico, owing to the thiek skin, good keeping qualities, and fine flavour. In the warm and extremely moist climate of Alta Vera Paz, specimens of this form were in perfect condition two weeks after picking. Specimens sent by mail from Coban to Washington, while overripe on arrival, showed no outward evidence of decay, and were still in condition to withstand rough handling.

Thick-skinned oval.—This description was drawn up to cover two specimens purchased at different times in the market of Guatemala City. Form oval or oblong; surface roughened with knobs; skin thick and unyielding, breaking rather than tearing, granular in texture; flesh distinctly differentiated from the skin; seed longer than broad, rounded at the apex, covered when ripe with a mealy substance; coats adhering closely to the seed and separating from the flesh when ripe.

Soft-skinned Guatemalan.—Fruit pyriform: surface slightly roughened, shining, skin thick, soft, and yielding, tearing rather than breaking, distinct from the flesh; flesh free from fibres, firm, not darker near the skin. Seed almost spherieal, with the outer coat produced into an acute point; seed coats closely united to each other and to the cotyledons except at the base and apex. This form can hardly be eonsidered a true Guatemalan type, as it lacks the characteristic hard skin. It resembles the Cuban type in many particulars, but differs from it in having the seed coats adhering closely to the cotyledons over the greater part of the surface and in having the outer seed coat produced beyond the apex of the cotyledons. It more nearly resembles the Costa Rica type. In Guatemala there are at least two other species of Persea that yield edible fruit. These are known among the Indians of Alta Vera Paz by the names "coyo" and "coyocte." Both are generally considered very inferior fruits, though some prefer the "coyo" to the avocado. In Alta Vera Paz the "eoyo" and the avocado flower at about the same time, but the fruit of the "coyo" ripens at least a month earlier, a fact which may lend interest to the species in efforts to extend the season. In the highlands of Central Guatemala the avocado is found in the regions that are occasionally subjeeted to temperatures below freezing. The fruit is of good size and quality, and the thorough exploration of this region offers interesting possibilities in the securing of more hardy forms.

Porto Rico.—The avocados of Porto Rico, although showing great diversity of form, are apparently very closely related, indicating possibly that they are the result of a single introduction. Compared with the types of the mainland thus far studied, their affinities seem to lie with Mexican avocados. From these they are distinguished ehiefly by the character of the seed, the Porto Rican type having the two seed coats distinct, the outer usually adhering to the flesh, the inner more or less closely attached to the cotyledons. In this respect this type also differs from all the continental forms thus far observed. From the avocado of Costa Rica it is further distinguished by the texture of the skin, which is much thinner and softer than the Costa Riean type. In this latter regard it is still further separated from the Guatemalan avocados with their hard, almost brittle skins. From the

Cuban type it is separated by the thinner skin, and the fact that the flesh and skin are not sharply differentiated. Form oval or pyriform, with or without a prolonged neck: colour green, usually light; surface shining and almost smooth; skin thin and soft, tearing rather than breaking; flesh not differentiated from the skin; seed spherical, oval, or slightly pointed; the two seed coats entirely distinct, the outer usually clinging to the flesh and the inner to the cotyledons. One specimen from San José, Costa Rica, seems to correspond closely with the Porto Rican forms, the only difference being a slightly thicker and more distinctly differentiated skin.

MEXICO.—The Mexican varieties show the greatest diversity of form, and also a considerable range of colour. With the exception, however, of three special forms to be mentioned later, they seem to intergrade and form a connected series. They are at least much more closely related to each other than they are to those found in other countries. Although many of the Mexican avocados were of really excellent flavour, none were seen that appeared particularly desirable for introduction. The following is a general description covering the more characteristic features of the Mexican type:—Form spherical, oval, oblong, or pyriform; colour varying from green to almost black; surface shining and almost smooth; skin thin and soft, tearing rather than breaking; flesh not differentiated from the skin; seed spherical, oval, or pointed; the two seed coats closely united and usually attached to the seed over the greater part of its surface.

Tapachula.—This sort was first observed at Tapachula, Chiapas, Mexico, where a single tree was found growing in the park. The same or a very similar variety was afterwards found in Costa Rica. Form of fruit obovate or slightly pyriform; colour bright green; surface shining and with slightly raised points white at the top; skin thin and leathery; flesh but imperfectly differentiated from the skin; seed nearly round. The tree rather short and spreading. The leaves broadly acuminate, almost transverse at base, the broadest part of the blade usually in the proximal portion. This is apparently one of the most desirable of the thin-skinned sorts. Fully matured fruit was seen neither in Mexico nor Costa Rica; consequently the character of the seed coats could not be determined. The Costa Rican specimens, while closely resembling the Mexican tree in the shape of the leaves and habit, as well as in the form and peculiar markings of the fruit, differ in having ovate seeds, while in the Mexican specimen the seeds are nearly round.

Long Neck.—Of the two samples included in this description one is from Tapachula; the other was purchased in the Washington market and was probably from Cuba. The resemblance is doubtless confined to formal characters. Form elongated, with a very long curved neck; colour green; surface shining and somewhat wrinkled; skin soft, tearing rather than breaking; flesh distinctly differentiated from the skin; seed decidedly longer than broad, rounded at the apex; seed cavity extending into the neck beyond the apex of the seed; the two seed coats entirely distinct. The flavour and texture of this form are very good, but it will probably not prove to be a good shipper.

Clingstone.—This most aberrant form was found only once in the City of Mexico. It is so very different from the ordinary avocados that it would seem that it must belong to a distinct species. Nothing was learned, however, concerning the nature of the tree, and the natives classed it with the other "aguacates." Form elongated; colour light green; skin soft and pliable, the surface somewhat shrunken and wrinkled; flesh granular in texture and almost tasteless, adhering closely to the seed; seed narrow and pointed; the two coats, if they exist, cannot be separated. The oddity of this form is its only recommendation.

COSTA RICA.—The avocados of Costa Rica show a greater diversity of colour than those of any other country visited by the writer, ranging as they do from almost white to black through various shades of green, red, and purple. There is also a great variety of shapes. Still, with the exception of the "yas," they form a very connected series and are easily distinguished from those of other countries. As a group they may be characterised as follows :—Fruit spherical, pyriform, or gourd-shaped; colour green, red, purple, or nearly black; skin rather thick, soft, distinct from the flesh. Seed spherical or with only the outer seed coat produced into a point; seed coats closely united to each other and to the cotyledons over almost the entire surface. In the market at San José, Costa Rica, one specimen was found that could not be distinguished from the common Porto Rican type except that the skin was somewhat thicker than any observed in Porto Rico. A few samples of a form not elsewhere seen were also found in the same market. These were slender necked, with the seed cavity extending into the neck, the seed was oblong, the skin very thin and not distinct from the flesh, which was slightly darker than the skin. These specimens had a very fine flavour and would be desirable for local consumption; the thin skin, however, would probably prevent their being successfully shipped. Of the ordinary type none was seen that had marked desirable qualities.

CUBA.—The avocados of Cuba are closely related to those of Porto Rico, the principal differences being the thicker skin of the Cuban fruit, and the fact that in the Cuban forms the skin is quite distinct from the flesh, which is not darker near the skin. The thicker skin may explain why Cuban fruit reaches New York in better condition than that of Porto Rico. Fruit pyriform or nearly spherical; surface smooth and shining; skin thick, soft, and yielding, tearing instead of breaking, distinct from the flesh; flesh free from fibres, firm, not darker near the skin. Seed nearly spherical or pointed; seed coats entirely distinct from each other and from the cotyledons. Flavour poor. Specimens on which this description was based were found in the Washington market and were said to have come from Cuba via New York. The flavour was very insipid, which may have resulted from the fruits having been picked when immature, or to overripeness.

HAWAII.—A series of specimens shipped from Honolulu to New York shows a soft-skinned fruit, in general like the avocados of Costa Rica, but much larger. Form oval, oblong, or pyriform; colour green or purple; nearly smooth, shining; skin soft, of varying thickness; flesh distinctly differentiated from the skin; seed longer than broad, variously shaped; the two seed coats usually united and adhering to the cotyledons, except at the base and apex. A peculiarity not observed elsewhere is that of maturing several fruits in a cluster. In most countries all the fruits of a cluster, except one, drop when very small.—*U. S. A. Department of Agriculture, Bureau of Plant Industry.*

(To be concluded.)

FRUIT CULTURE AT NUWARA ELIYA, CEYLON.

Going round the fruit orchard at Lake View, Nuwara Eliya, belonging to Mr. John Cotton, a luxuriantly grown grape vine was seen, about to bear for the first time, showing splendid clusters of grapes which have set. The vine is under the eaves of a cattle-shed covered with zinc. The eaves have been extended out with a two feet length of glass, and under it the vine (of the Champion Muscat variety) is doing famously. Mr. Cotton regrets that the vine was unfortunately put under eaves not more than 5 feet from the ground. The raising of the entire length of the shed would be unsightly from the Badulla road, from which passers can look straight on to the shed. Mr. Cotton,

however, hopes to propagate some acclimatised plants by training the branches down to the earth and covering little lengths of them with sand, and by ringing round the stems and binding moss on them. The vine grown in the wall inside the yard by the house is not doing so well as the one referred to, which was imported at the same time.

Mr. Cotton is of the opinion that no fruit can be grown to pay in Nuwara Eliya, excepting the cooking pear. The three Kentish Fill-basket apple trees, which had a few fruits on them last September, were pruned—and for the first time their roots were dug round and pruned, with the result that the trees had twenty well-set fruit, but the frost has reduced the number to twelve. Fruits come on at the wrong time of the year in Nuwara Eliya. The Red Heart plums yield bushels of fruit from May to August, but they get cracked by the winds, and the rains rot the fruit before it gets a chance to ripen. My attention was called, however, to a well-grown bush of the Emperor of China Mandarin Orange, barely five years old, not quite 4½ feet high, but quite five to six feet in circumference round the bush, on which were some twenty fruits, some of them of the size of a small cocount. Mr. Cotton had picked a good many of them beside those on the tree.

One drawback to orange culture at Nuwara Eliya was that the skin and rind of the fruits was too thick—those of the fruit referred were quite half-an-inch thick. A certain Nuwara Eliya orange grower held the opinion that the skin and rind would get thinner and thinner every year, but Mr. Cotton said, if that did happen at all, it would take 10 to 12 years from the time the trees began to bear. At Mr. A. W. A. Plâté's orchard, behind his studio, I was shown a beautifully-grown Washington navel orange tree laden with over fifty fruit. The tree was the result of a bud from the Scrubs Estate, grafted by Mr. Plâté himself to a stock of the common Ceylon citron. Mr. Plâté's system with regard to all fruit trees is to constantly prune their centre branches, in order to get the sun to play into the very heart of the tree. The orange tree, in question, had about eight to twelve outer branches, drawn out and tied to stakes, resembling an open umbrella. The same was done with his Red Heart Plums. Mr. Plâté holds that all fruit trees in Ceylon produce too much wood which should be lopped and pruned so as to let the sun harden up the branches on which the fruit are to be produced. The system is open to criticism, but the results he has obtained justify his adopting it. His orchard has twelve other imported Washington Navel orange plants, a number of Red Heart plums and imported fig plants. Of two dozen orange plants he had got out through Messrs. Thompson, Thomas & Co., about a year ago, he had given a dozen to the Grand Hotel. This variety of orange is much smaller than that of the Emperor of China Mandarin, but has evidently a thinner skin. I was also shown a moderate-sized glass-house in which Mr. Plâté intends to grow Hamburg grapes.—*Ceylon Observer.*

SORTING AND GRADING OF TEAS FOR THE COLOMBO MARKET.

Some years ago teas were generally sorted into three grades, viz., broken pekoe, pekoe, and pekoe souchong. Under modern conditions, however, this grading is very rarely employed, and there now is a considerable tendency to eliminate the last-mentioned grade almost entirely from the factory output. At the present time teas are usually sorted into at most five grades, if we exclude dust and fannings from the reckoning. There is no question but that the more grades, up to four or five in number, manufactured, the truer the sorting of the leaf

becomes. Such is not, however, economy in small factories, and a selection has, therefore, to be made in these cases that will produce the best results for the given class of leaf dealt with. Generally speaking, a division into broken orange pekoe, broken pekoe, and pekoe, is the most economical method of sorting for a small crop, but in some cases an orange pekoe grade is substituted for the broken pekoe. This has the drawback of entailing a large percentage of fannings; or else the broken orange pekoe is, by the admixture of the orange pekoe fannings, reduced to the level of an ordinary broken pekoe tea. Either alternative is equally unsatisfactory, and therefore the first-mentioned grading may be considered the most suitable for estates of a moderate acreage. The following remarks, while applying to such properties, are, perhaps, more directly of interest to those who can arrange to make at least four grades.

BROKEN ORANGE PEKOE.

This is usually the finest and highest priced grade manufactured, and is essentially a "tippy" tea. Liquors are not, as a rule, as strong as in the broken pekoe. The tea should answer to its name by being of an orange pekoe character, though it may contain a certain amount of broken leaf. This latter, however, should not be of a large percentage, and should only consist of the fine quality leaf that may have been present in the "Dool." The tip ought to be a good colour, and show up well in the tea. With the above characteristics a broken orange pekoe will sell at a most remunerative price in Colombo. Such a tea is suitable for nearly all the markets supplied from Ceylon, and is eagerly sought for by the trade, who are generally ready to pay satisfactory rates for any tea which possesses a sufficient show of tip, and is of even and well rolled appearance. To secure this "tip" in the tea is not an easy matter. The withering, methods of rolling, character of leaf, wet or dry weather, and form of roll-breaker, all exert their influence on the appearance of the grade.

It may, however, be premised that light-rolling is absolutely necessary for a "tippy" tea. As such is detrimental to the strength of liquor in the other grades, the usual rule is to roll lightly for the first, and possibly the second roll, and to only use the "Dool" from these rolls for the sorting of the broken orange pekoe. This necessarily entails a low percentage outturn, but, provided it be not unreasonably short, and the show of tip be a good one, the fact is of no great importance. The average percentage of a "stand-out" B.O.P. rarely goes beyond 18 per cent., and is generally about 12 to 15 per cent. of the crop. Many so-called B.O.P.'s much exceed this outturn, but, if they realise high prices, this is due rather to their liquoring qualities than to any superiority of appearance or grading.

There is one rather curious point about a B.O.P. that calls for remark. The question of fine, medium, or coarse medium plucking (I speak of course of commercial samples, and not of "fancy" teas) does not effect the outturn of "tip" in this tea to anything like the extent usually thought possible. In fact, with medium plucking, a very fair show of "tip," quite equal to that obtained by fine plucking, is often produced. This is due to the fact that the roll-breaker sifting to a great extent separates the coarse and fine leaf. The character of the leaf, whether off tea, young or old, from pruning, the methods of plucking employed, and the richness of the soil, have much more to say to the question than the actual quality of the leaf taken into the factory. The wither is also of very great importance, though herein that which is most suitable for the manufacture of really "tippy" teas is as a rule by no means the best for cup quality.

A good deal yet remains to be done in the improvement of roll-breakers. The latter, as usually supplied, are, generally speaking, unsatisfactory in their working, the sifting of the leaf being very incomplete. A quicker vibration, but

a considerable less "throw" to the sieve is, I have found, a decided improvement in this respect. As regards the sieve through which a standard sample of B.O.P. is obtained from the made tea, a No. 10 of thick wire, or a No. 12 of thin wire, mesh on the machine sifter is that usually employed. The actual mesh used, however, naturally varies with the machine, according to the slope of the sifter and the length of time the leaves remain on the trays during the process of sifting. Except with very light rolling, it is not advisable to take any of this grade from the "large bulk," unless the latter contains a good deal of "tip." In most cases the "Dool" leaf only should be utilised. In conclusion, a B.O.P. grade ought to be a "tippy," more or less whole-leaf, tea, of fairly even appearance, and free from dust and small fannings. No sifted out broken tea from other grades should ever be added to it.

ORANGE PEKOE.

The standard of this grade has changed very much in the past few years, and what used to be ranked as a good orange pekoe is now classed as a wiry pekoe and paid for accordingly. An orange pekoe ought to be absolutely free from broken leaf. It should be wiry and even, and contain no pekoe tea. In many cases invoices still reach the market that are labelled O. P., but which bear no resemblance whatsoever to this grade, consisting, as often as not, of a good deal of pekoe leaf, forced through a No. 10 or 12 mesh, combined with small broken leaf and large fannings. As a result the tea sells on the average at about the rates for pekoe, and sometimes at a lower figure. It is in no sense an orange pekoe, and marking it as such is an actual drawback to its value, while the fine O. P. leaf contained in it, that would otherwise sell at a high price, is of course utterly wasted.

The value of O. P. on the Colombo market is extremely variable, and, to secure attention, this grade must be finely sorted and absolutely free from fannings or broken tea. Through a No. 10 thick mesh, or a No. 12 thin mesh, is about the limit allowable, and with this the sorting must not be forced.

To clean the tea, fanning with a rice "solivon" may be employed, but this process is extremely slow and expensive, or a No. 14 wire mesh hand-sieve may be used. The latter requires careful handling if it is to remove only the flat leaf. The method I am personally in favour of is to use a No. 14 bamboo sieve. A large quantity of tea can be treated in half an hour, and, with proper attention, the wiry leaf all remains on top of the sieve, as it does not catch on the smooth bamboo surface, and the fannings, or flat leaf, fall through. "Tip," though of advantage in an O. P. grade, is not a necessity. In fact, for such markets as Germany, a "tippy" is not in demand. The finer and more even the sorting of this grade, provided the tea be of wiry appearance, the greater the value. Very often a price equal to, or even better, than that secured for the B. O. P. may be otained if a really well sorted, fine, wiry O. P. of stand out make is sent forward.

The usual percentage of this grade varies from 10 to 30 per cent., but the latter outturn generally means a bold tea, containing much pekoe leaf. This is not an attraction, as there is more than an ample supply of such tea already on the market. A more reasonable limit of percentages is from 10 to 18 per cent, and at this a very fair sample can be made. Plucking has not much influence on the grade, except in so far as coarse plucking means the presence of "red ends." These may, however, to a certain extent be removed by picking over the tea by hand. One of the finest samples of the tea I have seen was made from low-country medium plucking; the sample in question being like a mass of thin twisted-up wires. Rolling, however, is the great factor on which the outturn of this grade depends. Really hard rolling will usually produce a very attractive sample, noticeable on account of the wiry and fine, clean twisted character of the leaf.

BROKEN PEKOE.

This grade is generally used as a blending tea, but in some cases, especially in London, when the liquor is of good quality, and the appearance is above the average, the tea is shipped to such markets as the North of Ireland for consumption unblended. A broken pekoe tea usually consists of a good deal of flat leaf, together with a fairly large proportion of fannings. It should, however, be free from dust, and from admixture with whole pekoe or wiry O. P. leaf. In cases where the intrinsic liquoring quality of a crop is of a high character, the inclusion of fannings, obtained from the pekoe grade after cutting or breaking, is not of much consequence, though the appearance of the broken pekoe unquestionably suffers thereby. When, however, liquors are of medium quality, or thin in the cup, the fannings or broken flat leaf sorted out from the pekoe grade tend to greatly reduce the strength, thickness, and pungency of a broken pekoe, if added thereto in any quantity. Under such circumstances their inclusion is inadvisable. The same objection does not apply to the "Dool" fannings, as these, consisting of the particles of the finer leaf broken up in the rolling, usually carry a stronger liquor, and thus add to the cup qualities of the grade.

The sorting of this tea is a matter requiring some care, so that it may only contain the broken or flat leaf, which draws a thicker liquor than the more wiry unbroken portion of the bulk. Quick sorting is decidedly advisable, so that the long leaf may pass over the sieves, and only the flat leaf fall through. Bamboo sieves are also a great help in securing a true sample. The "Dool" from the last roll, or rolls, should preferably form the large proportion of a broken pekoe, as the liquor thereof is generally full and coloury. "Tip" is not of much importance, though a certain amount is desirable to differentiate the tea from large fannings and to attract attention in the sampling room.

The total percentages of the above first three grades, viz., broken orange pekoe, orange pekoe, and broken pekoe, may run from 45 to 60 per cent. of the crop An outturn of 50 per cent., provided the teas are up to a really good standard of appearance, is a satisfactory mark to aim at, and will generally be found to give the most remunerative results in the great majority of cases. It is not, however, an easy ratio to reach, and demands ample rolling and power accommodation in the factory, if the conditions for appearance, laid down above, for each of the grades, are to be successfully realised.

PEKOE.

Pekoe forms the bulk of the output in every factory, and is, perhaps, the most difficult grade to manufacture of a really good appearance. Fine plucking has a very marked influence on the character of the leaf, but even with medium plucking, especially at low elevations, where the flush is free-grown and succulent, well-rolled pekoe may be produced by care and attention to the withering and rolling. Withering exerts the predominant influence on this grade. Green uneven withers invariably result in an undesirable pekoe. A hard wither on the other hand, for heavy rolling, or a medium even wither for light rolling, produces an excellent sample of well-twisted bulk.

Rolling is a matter demanding much attention, and has to be graduated to the wither. It is preferable to roll up the bulk into as small and close a leaf as possible, in order to obviate overmuch breaking or cutting of the tea afterwards. For this purpose a hard wither and hard roll is more or less necessary, as otherwise the production of a large quantity of flat leaf is bound to result, a green wither causing the leaf to break very easily when pressure is applied to the roll. In

the sorting of the tea it is, as mentioned in my previous articles, very inadvisable to cut or break the leaf overmuch, and a choppy appearance should always be avoided. Personally speaking I always make use of my own breaker for equalizing the tea, but, whatever cutters or breakers are used, it is as well to regulate the size of the mesh, or breaking apparatus, according to the character of the leaf of the original bulk. A slight boldness of leaf in a Pekoe is no drawback, rather the contrary, as compared with the resultant choppiness that is inevitable when a large and tightly-rolled bulk is reduced down to a small sized pekoe.

PEKOE SOUCHONG.

This grade is not manufactured in any large quantity, and, as it invariably sells at a low price, its outturn should always be curtailed. With hard rolling, and by suitable breaking, pekoe souchong, even under course plucking, may always be eliminated. This is already done on many estates, and a noticeable feature is that, as a rule, combined pekoe grade sells at the same rate as the pekoes of those neighbouring properties that may still be making a considerable proportion of pekoe souchong. I have, however, in Darjeeling seen a tea where a division of the two grades was certainly necessary. The leaf was plucked off China tea, and the pekoe souchong grade contained a very large number of the hardened-up older leaves, brought in by the pluckers. The appearance of the pekoe souchong in question was quite satisfactory, but the liquor was, in value, pence below that of the pekoe sample ; the actual sale prices of the two grades being about 6*d.* and 9½*d.* respectively. In Ceylon, however, these conditions rarely occur, the bolder tea in the bulk being merely unrolled leaf, while the greater portion of it is intrinsically of quite as good a character as that of the pekoe. Under these circumstances equallizing it down, and blending it with the pekoe, has no detrimental effect on the latter, while a gain of from ½*d.* to 1*d.* per lb. may result on some 10 to 15 per cent. of the crop. which is equivalent to from 30 to 90 of a cent per lb. on the whole estate output.

FANNINGS AND DUST.

Owing to the demand that has arisen for suitable fannings and dust for exportation to China, where they are manufactured into brick teas, some care in the preparation of these grades will be well repaid. It is of importance to see that the fannings are thoroughly freed from dust, and the dust itself cleaned of all tea fluff, in order to meet the requirements of the trade.

CONCLUSION.

Having thus dealt with each of the usual grades, and some of the various points of importance to be noted in their manufacture, I cannot perhaps do better than conclude by once more drawing attention to the rule that all teas should be so graded as to attract the maximum amount of competition. Full competition may only be secured by teas suitable to all, or nearly all, the markets supplied from Colombo. To meet this demand they must, as far as possible, be of a clean and distinctly-graded type, and, except in the broken pekoe class, of an even, whole-leaf character.

The question of quality I have not discussed. Such has little to do with grading, but those teas that combine flavour, strength, and pungency, with really good appearance, naturally benefit considerably from the extra care and attention in sorting which they receive. I trust in future papers to deal with the subject of improvement of quality by means of artificial manuring and cultivation. Such has been a much-sought-for possibility, and I am

not without hopes that we are now on the way to obtain at least a partial solution of the problem. That methods of cultivation have a direct bearing on the quality of teas produced is already well ascertained, but systematic working to this end has not, until lately, been undertaken on any considerable scale. Judging by results to date of writing there appears to be every probability of success, as far at least as up-country estates are concerned. The application to low-country properties is, however, likely to be a different matter, as while the pungency, strength, and colour of a tea may possibly be increased, the attribute of flavour is one that would seem to be almost entirely dependent upon climatic conditions. The extra value attached to the qualities of increased pungency, strength, and colour alone is by no means on the same level as that secured by the combination of these with flavour. The higher prices that might therefore result on low-country estates would not in many cases, as far as one can judge, afford an additional profit, though they might perhaps prevent the heavy drop in the earning power of a property that takes place, when the market value of teas for price falls below a certain figure.

It is needless to say that any method of obtaining a considerable improvement in the quality of the crop of an estate necessarily involves a greater cost of production, and for any scheme to be successful the increment in price must very much more than counterbalance such an enhanced expenditure. This, as stated above, will be a possible difficulty in the case of low-country gardens, but, on estates of higher elevation, it would seem that very favourable results may be hoped for. It may be remarked that, to raise the prices of a given estate, the maximum results will only be obtained from an improvement in the *intrinsic* qualities of the teas. Such is to a great extent a matter that concerns the field, and not the factory, working of a property.

No amount of attention and care in manufacture will ever improve the intrinsic value of a tea beyond a certain limit, determined by the quality actually in the leaf, when it is plucked. In the factory this quality may, it is true, be developed to the fullest extent, and herein, and in the sorting of teas for the markets to which they may be destined, there is much scope for scientific and practical knowledge. But, beyond this point, the value of the teas can only be increased by altered conditions of growth and cultivation; for finer plucking, accompanied as it usually is with a shorter crop and higher cost of production, seldom results in improved profits, except in a few individual cases, and therefore does not, as is well-known, solve the difficulty—*By Henry M. Alleyn in the Times of Ceylon.*

Maniocca Cultivation.

By J. P. Lewis, M.A., C.C.S.

It is only within the last quarter of a century that much attention has been paid to the cultivation of maniocca or cassava (*Manihot utilissima*). But it has been known in the Northern Province of Ceylon since Dutch times, for I find in the *Colombo Journal* of 1833 from a letter of Captain Nagel, Land Regent of the Wanny, that it was apparently growing in Mannar in 1792.* In the Mullaittivu District before the period mentioned it served merely the purpose of helping to form live fences,† but as regards modern times, it is only since 1885, when two cart loads of the plant from Jaffna were sent to Putukudiyiruppu by the late Mr. Robert Massie, Assistant Government Agent, and planted there, that it has been used in that district as an article of food. Here history repeated itself, and Mr. Massie only did what Captain Thomas Nagel did ninety years before him, but it is to be hoped with more lasting results. Here we have Captain Nagel, 114 years ago acting as if he belonged to the Agricultural Society, introducing maniocca and distributing leaflets in Sinhalese and Tamil describing the plant. It is unknown, strange to say, in the Mannar District, where it would, from Captain Nagel's letter, appear to have been first introduced by the Dutch.

In the Jaffna Peninsula it is cultivated in all the divisions except Pachchilaippalli and Vadamaradchi East. In Tenmaradchi it is cultivated in the villages of the Navatkuli, Chavakachcheri and Kachchai parishes. It is cultivated in the Islands with the exception of Delft. In Vadamaradchi West it is cultivated but not extensively. Recently there has been a little cultivated in the villages of Madduvilnadu, Ponnaveli and Tampiray of the Punaryn Division and in Malla of the Tunukkay Division. There is none in Karaichchi or Karunavalpattu. The divisions where it is chiefly cultivated are therefore Jaffna and the three Valikamams, and in these the cultivation has greatly extended within the last ten years, and in the parishes of Tenmaradchi named above the quantity cultivated has increased nearly three-fold within that period. In the Islands Division there was a considerable increase in 1905, the first year in which there was any cultivation to speak of, as the people devoted most of their time to tobacco cultivation. This was in Karritivu.

The approximate extent cultivated in the Jaffna Peninsula is:—

Valikamam North	acres 570
Valikamam West	160
Valikamam East	50
Jaffna	50
Tenmaradchi	30
Vadamaradchi West	15
Islands	10

It is noteworthy that the divisions with sandy soil, which is best suited to the plant, are pre-eminently those of Tenmaradchi, The Islands, Pachchilaippalli and Vadamaradchi East, in the two former of which there is very little cultivated, and in the last two none at all.

The extension of cultivation of the plant is due to the yam having become a popular article of food among the poorer classes in these divisions; in fact, it is described as having, in most of the divisions in which it is cultivated, become a popular article of food, and in Valikamam West, in fact, the staple article of food of the lower classes and as having taken the place of *pinaddu*, the preparation of which

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* See Annexure A.

† I have seen it lately growing in fences at Pampaimadu and other villages in the Mullaittivu District.

produce of the palmyra is consequently much neglected. In Vadamaradchi West the use of it as food has extended to the higher classes who, however, make but a sparing use of it. In view of its increasing popularity as an article of food and of the extension of the cultivation of the plant in consequence, it is a question whether it would not be wise to introduce it and to endeavour to popularize it in the Mannar districts and in the divisions of Jaffna in which there is no cultivation of it, viz., Vadamaradchi East, Pachchilaippalli, Karaichchi, Punaryn, Tunukkay, Karunaval Pattu and Delft. It would be an advantage to the people to have another article of food to turn to. I had written this sentence before I found Captain Nagel's letter; it is interesting to find him using exactly the same argument, "it is certainly better to have an article of food more than less in a country."

Although it is not cultivated in Pachchilaippalli, it is appreciated even there as food, and the people of that division, whose time is chiefly given up to tobacco cultivation, buy it from the people of other divisions.

The Assistant Government Agent of Mullaittivu thinks that in course of time it will become a popular article of food in his district also, where the people are just beginning to appreciate it, and where the cultivation has also increased. The difficulty in the days of Captain Nagel, as it is now, was to get the people to take to it, owing to their addiction to dry grains and jungle roots.

It is grown chiefly in garden lands, where the cultivation is extensive in separate plots, but in other places in the midst of dry grains such as kurakkan or sami, or on the borders of lands cultivated with tobacco, chillies, brinjals, etc. It is propagated from the stem which is cut into pieces about one foot in length, the old trees of the former cultivation being preserved for this purpose. These pieces are planted three feet apart, and are watered every two or three days for six months until the plants are firmly established. After six or seven months the roots can be dug up for use as food, and they must be used within two or three days after they are dug up, as if they are kept longer they become poisonous.

Lands which it is intended to plant with maniocca are ploughed or hoed, and in some cases manured, but not always. Manuring is usual in the Islands for instance, but in Valikamam North, where the soil is richer, it is not usual to manure. The plant does not require much manuring, but manuring of course increases its growth. The best manure is considered to be palmyra olas or green leaves buried half a foot deep. The different soils have different effects on the growth of the plant. Where the soil is reddish and hard as in Valikamam North, the root is generally three feet in length and one foot in circumference, but in sandy soils as in Tenmaradchi the root grows much longer and thicker. In 1891 a maniocca root six feet in length was brought to Jaffna by one of the Maniagars.

The cultivation goes on throughout the whole year. In places with sandy soils it is usual to plant in January, but in other places it is planted generally in May with the dry grains, such as sami, which are sown in that month. The water that irrigates the dry grain then serves for the maniocca plants also, and when the dry grain is reaped, the beds are made up again, and the maniocca watered every two or three days; or in some places, such as in Valikamam East, every four days.

Manner of Use as Food.—There are two ways in which it is used:—

(1) The roots are peeled, cut into small pieces, boiled or baked or buried in hot ashes, and eaten with or without curry.

(2) The roots are sliced into thin pieces which are dried in the sun and pounded into flour. Cakes are made from the flour in the same way as cakes are made from rice flour. The former method is the most common.

It is, I believe, a fact that the flour is much used by the bakers of Jaffna in adulterating wheat flour. The leaves are used as fodder for cattle, but care has to be taken that they are given dry, otherwise they give rise to wind in the stomach sufficient to cause death.

I have obtained from the Government Agent, Eastern Province, an account of cultivation in the Eastern Province, and Mr. A. E. Byrde, Chief Irrigation Inspector, has been good enough to send me a paper on the same subject which is appended.* I also annex a description of its cultivation and preparation as food in British Guiana taken from Sir Everard im Thurn's book "Among the Indians of Guiana."†

As in Jaffna it is found both in the Eastern Province and in British Guiana that a sandy soil is best suited to the plant. It is cultivated in the Eastern Province usually in chenas and in clearings for paddy fields where the ground is not too low. It is generally planted at the beginning of the North-East Monsoon rains about August or September. The result is that in the Eastern Province no watering of the plant is required or carried on. The practice here differs from that in the Jaffna Peninsula where the cultivation is started at all times of the year, and consequently some watering is necessary. I do not suggest that the Jaffna practice should be altered, as no doubt the Jaffna cultivator has discovered by experience what suits him best, but if the cultivation is extended in the Vanni and introduced into the more remote divisions of Jaffna and into Mannar, the time for planting should certainly be September or October, so as to obviate the necessity of watering.

It is usual to put in two cuttings in each bed in the Eastern Province, in British Guiana three or four. In Batticaloa it takes 14 or 15 months for the plant to grow sufficiently for the root to be fit for use, and consequently the roots are usually dug up in the last quarter of the year. In some places where the soil is more forcing 12 to 13 months are sufficient. In British Guiana according to Sir E. im Thurn the period is 9 or 10 months. It is noteworthy that in the Jaffna Peninsula the period is only 6 or 7 months. This probably means that the Jaffna man takes more care over the cultivation, or it may be due to the watering.

In Batticaloa instead of being planted with dry grains it is planted between coconuts or in a new clearing for paddy between rows of Indian corn. The cultivation in that district is extending with the extension of new clearings. Formerly it was cultivated in chenas, but chena cultivation is now stopped. When the Veddahs were induced to take to cultivation, they were required to cultivate among other things maniocca. They did this at first perfunctorily, but when they found how useful it was as food, they carried on its cultivation voluntarily.

In the Batticaloa district it is, during the winter months, the mainstay of the large number of paddy cultivators living in the interior. Why should it not be the same in the Vanni? I know of no reason beyond the disinclination of the people to try any new sort of food or cultivation. The result is that when their paddy crops fail, as they often do, they live on jungle roots and leaves, or have to be supported by relief works.

I would allow them a certain extent of chenas on condition that they cultivated maniocca in them, so as to popularize the cultivation of this plant.

In the Eastern Province large quantities of the yam are dried into *odiyals* which are sold or exported, and these are of great use during time of scarcity or famine. This use of the yams in large quantities is unknown in Jaffna and quantities

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* Annexure B. † Annexures C. and D.

of the *odiyals* find their way from Batticaloa into the Jaffna market. In Batticaloa it is the coconut estate proprietors who turn maniocca to account in this way. I commend the cultivation of maniocca and the drying of the roots wholesale to the estate owners of Pallai, Punaryn and Vadamaradehi East. These *odiyals* keep in good condition for a year or more.

As regards its use as food, maniocca in the Eastern Province is also converted into soup and into *kanji* mixed with syrup. In the East Indies it has further uses such as the preparation from it of cassareep unknown in Ceylon which are fully described in Sir E. im Thurn's book. It is, I believe, a wholesome food, and although Sir E. im Thurn refers to one result which is supposed to be due to a cassava diet in South America, viz., *orbus veteribus notus*, "the globe known to the ancients,"* I do not think that this result has been observed in Ceylon.

The yield per acre in the Eastern Province is estimated to be between Rs. 60 and Rs. 90. There are 1,000 beds per acre, and each bed brings in from 6 to 9 cents. Traders buy the produce of the beds wholesale at the clearings and make a substantial profit out of the transaction, as they retail the yam in the bazaars at 1½ to 2 cents a pound. It is a popular food in the Eastern Province, and along with kurakkan and Indian corn it has tided over many a season of scarcity and famine. I should like to see it and Indian corn do the same in those parts of the Northern Province which comprise the larger portion of it,† where the people periodically suffer from the failure of their crops.

With reference to Mr. Byrde's paper, both varieties of the sweet maniocca, the pink and the white, are found in Jaffna, the latter being the more common.

His statement that the quality of cassava is affected by the species of trees grown near it is curious, and it would be interesting to learn whether it is confirmed in the experience of members of the Agricultural Society and by scientific investigations. The *kokkaddi* tree is the *Garcinia spicata*, sometimes called the wild orange.

(Annexure A.)

Letter from M. Thomas Nagel, Commandant of the Wanny, to His Excellency J. W. Van De Graaf.

(Translated from the Dutch Records.)

Moeletivoe, 21st June, 1792.

Hon'ble Sir,—I had the honor of receiving your Excellency's letter of the 2nd instant together with a Singhalese and Tamul translation of a description of the Manioc root, and I have caused copies of the same to be circulated among the inhabitants here. As soon as the plant is introduced from Mannar, I shall from time to time report to your Excellency how the cultivation of it thrives. I believe that but little expense will be required to promote its growth, and I shall strongly recommend it to the attention of the inhabitants of this district, but I doubt whether they will bestow much labor upon it, as there are two kinds of roots growing in the jungle at this place, which afford the inhabitants subsistence in years of great drought and scarcity. I have myself sometimes used them instead of Potatoes. The Malabars call them 'Allekalenga'‡ and 'Kawelee Kalenga';§ the former grows to the height of from 4 to 5 feet and to the thickness of about 6 or 7 inches and sometimes more, and the latter though knotty differs very little in size from the other.

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* See Annexure E.

† At Mahamayilankulam in a Sinhalese village near Vavuniya I saw some maniocca and Indian corn growing in some of the compounds.

‡ Allai kilanku. § Kavalai-kilanku.

These roots grow without cultivation in the jungle and form the chief food of bears. I cannot compare them to any other root than to the Yam; when boiled, the former has the same taste as the Potatoe, and even excels it in its mealy qualities, but the latter is somewhat coarser; both, however, are wholesome food, and if the inhabitants of the Wanny had not had these roots the last three years during the great scarcity, the 10, or 12,000 parrahs of paddy which were imported here would have availed little for the subsistence of the immense population, as the greater part of it was employed as seed.

Hence, as these roots are both in time of need and at other times used by the inhabitants as food, which they have only to dig up, and although they may not in wholesomeness and excellence surpass the Manioc, at least equal it, I think the inhabitants will feel but little inclined to bestow particular care on the new introduction.

And besides, on the prevalence of a dry season and on occasions of a bad crop, the poor or the idle who are averse to work in the fields, may easily provide themselves with a considerable quantity of 'Warigae' and 'Natchene,' the latter being a grain that produces a hundred-fold without the aid of water, and it is on this that the greater part of the Malabars at our place subsist. I have tried it and found it to be good, somewhat similar in taste to barley, and I am led to think that the facility of obtaining these grains contributes greatly to prevent the cultivation of paddy, the sole inducement of the people to grow Paddy being to procure with the produce of its sale the clothing they require, and also a variety of food, otherwise I really think that the culture of this grain would be entirely neglected. It was this circumstance that induced me, on my arrival here, to impose a tithe to be paid to Government on all kinds of grain indiscriminately. The 'Warigae' tax is again farmed out for the delivery of paddy, and produces generally three to one, that is to say a parrah of Paddy is delivered in lieu of three parrahs of 'Warigae.'

For the above reasons I fear I shall encounter some difficulty in persuading the inhabitants that the manioc root is preferable to the other products which Providence spontaneously furnishes them, but as this root may also be employed in the hour of need, and as it is certainly better to have an article of food more than less in a country, I shall cause it to be diligently planted in this Province.

I have the honour to be, &c.,

(Sd.) THOMAS NAGEL.

(*Annexure B.*)

CASSAVA.

Introduction.—The "Cassava" or "Maniocca" is a native plant of the West Indies, and it is not known when, and by whom this plant has been introduced here. It is called "Mayyokka" in Sinhalese and "*Mayya* or *Mayo Kilanku*" in Tamil. It is universally known by its principal product "*Tapioca.*"

Varieties.—There are many varieties of this plant. In the first place they are divided into two kinds, viz., *sweet* Cassava and *bitter* Cassava. The bitter Cassava is said not to be found in the Island.

Out of the many varieties of the sweet kind the commonest two kinds are the *white* and *pink.*

Description.—It is a bushy shrub growing to about *5 or 6 feet.* It has tuberous roots like the dahlia.

Peculiarities.—I have found that this plant very often borrows its "goodness" or "badness" from the trees around which it grows. If grown near a "*kokatia*" tree in Batticaloa the yam is useless for eating, and serious results may be the issue if eaten.

Its use in other Countries.—It is the staple food of the Indians of *British Honduras, Columbia, Guiana, Jamaica, Trinidad, Paraguay, Florida* and *Brazil.* There are factories for the manufacture of starch in *Jamaica* and *Florida,* and in these two countries, where the crop is estimated to be 9 tons per acre, thousands of acres are under cultivation.

It is also used as an article of food for cattle as "every beef animal can be put in the condition of western stall-fed cattle by the simple use of Cassava at a mere *fraction of the cost* to the corn-feeders of the west." This starch is said to be far superior to wheat starch.

Cassava is cultivated in all the French Colonies, and the making of *Tapioca* is one of the most interesting of all the French Colonial manufactures. The starch is employed besides in many manufactures—*paper-making, soap-making,* in the making of *glucose* or *starch sugar,* and in making *size* and *adhesive pastes.* Cassava *flour* is also used in the preparation of cakes.

Its Cultivation in the Island.—It is grown by natives in small patches in the "upcountry districts" and in the Eastern Province. Many of the English planters have grown Cassava on a large scale in the *Batticaloa district.* I have seen patches grown all down the *Southern Province* and about *Awisawella* and *Ratnapura.*

Except in Batticaloa the extent under cultivation is very small and not sufficient even for the *local use.* The tubers or roots always find a ready sale in the market; many hawker women are seen with *boiled Cassava* for sale on the streets of Colombo and Kandy. A few have tried with success the experiment of preparing *Cassava flour,* but the commonest use is to cut the yams into pieces of about 2″ cube and dried. This is known in the Batticaloa District as "odiyal," and a great demand is to be found among traders with Jaffna.

Its use in the Island.—It is eaten as a vegetable after boiling or roasting (native method of shoving a yam into hot embers). It has taken the place of potatoes or yams at many a well-to-do man's house. Many a poor family depends on it as their only meal when no rice could be had.

Soil, Method of Planting and the Yield.—It thrives best in the light sandy soil. It thrives under the most *diverse conditions of climate,* on dry plains, on rocky hillsides as well as humid plains and hills—wherever the soil is rocky or gravelly. The plant is cut into pieces from 3″ to 1′ 6″ and planted 3′ apart. Very often two pieces are planted in the same hole cross ways, like an X. The yield is from 8 to 10 tons an acre, or from 40 to 80 lbs. per plant. It is drought resisting and therefore even 14″ of rainfall can secure an abundant crop.

Time of Cultivation.—The best time for cultivation is to plant the stick cuttings as soon as the monsoon breaks. From time of planting to harvesting the least time is 6 months, and therefore in places where both the North-East and South-West rains are received two crops can be gathered in a year. To get a good crop it must be planted annually. In districts where chena cultivation is carried on, it is best to plant Cassava before *kurakkan* is sown.

Advantages, Commercial and Otherwise.—1. Roots or tubers produce more starch per acre than any other vegetable or grain.

2. It thrives best in light sandy soil, which is not thought of much worth.

3. The starch is said to be superior to wheat starch.

4. It can be used for fattening animals.

5. Different kinds of beans and other grain can be grown with it.

6. It can be utilized in more ways, can be sold in more different forms, can be more cheaply converted into staple and finished products, and can be produced for a smaller part of its selling price than any other crop.

7. There will be a market for it always, as the natives of this Island are accustomed to its use as a nourishing food.

Methods of Hand Preparation.—The bitter Cassava is only used for preparation of starch for the laundry &c., and therefore the following particulars are given only as regards sweet Cassava :—

(1.) Rasp the pieces of the tubers and soak the material in water. The sediment which is formed at the bottom of the water when collected and dried is good flour which can be used in the preparation of cakes or as starch.

(2.) Skin the tuber and boil it, then use it immediately in place of potatoes or yams or dry it. These dried tubers can be pounded and made into flour. The flour is good for baking native cakes or "Rottees."

(3.) Scrape the skin and make into curries.

(4.) Scrape the skin and boil with chillies and salt and saffron and use as diet as any ordinary food. This is the most common mode of eating amongst the Sinhalese and Tamils.

Cassava Poison.—It is said that there is Prussic acid or Hydrocyanic acid in Cassava, and it is therefore considered a poisonous substance.

Prussic acid is easily got rid of by thoroughly heating the substance, and therefore if the following precautions are taken, deaths from improperly-prepared Cassava will not be heard of. True that these deaths are amongst the badly-fed and neglected children, but the remedy or precautions are simple, and there is no need to neglect them.

(1.) Carefully scrape off the skin and the other portion or rind whereby the greater portion of the poison will be removed.

(2.) Thoroughly heat the remainder by boiling, or otherwise so as to destroy or drive off any remaining Prussic acid.

(3.) Eat Cassava only after it has been freshly cooked, as Cassava which may have been cooked and kept may yet be a dangerous substance.

References.—In addition to my personal experience and knowledge of Cassava, I am indebted to Mr. Charles Taldena, R. M., and others for their kind assistance, and to the articles on Cassava plants published in the several copies of the *Tropical Agriculturist* noted below. I invite reference to those articles as they are worth perusal :—

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,, XXI. ,, 12 of June, 1902.
,, XXII. ,, 4 of October, 1902.

Conclusion.—It is imposible to exaggerate the importance of a great Cassava industry in Ceylon. The land is rich without artificial fertilisers. The cultivation should be encouraged, as every villager can cultivate a few acres yielding at least ten tons per acre. Besides its uses as a food which are very numerous in form, its produce is sure to find a sufficient market as soon as the large capitalists take up the

cultivation and bring a sufficiently large amount to justify the erection of machines for the manufacture of starch and glucose for exportation. This nutritive plant will take its place with the coconut tree, the tea plant and the rubber plant as one of the chief products of this Island.

A. E. BYRDE,
VAVUNIYA.

7th December, 1905.

(*Annexure C.*)

CULTIVATION OF CASSAVA IN BRITISH GUIANA.

It is cultivated in what we should call chenas and, Mr. im Thurn states, flourishes best in sandy soil. "At the beginning of the . . . wet season, the women come . . . carrying on their backs baskets heavy with a load of cassava sticks to be used as cuttings.

Here and there at irregular intervals they loosen small patches of the soil, hardly more than a foot in diameter, and in each of these they insert three or four cassava sticks . . . .

At last in the ninth or tenth month seeds appear among the hemp-like leaves at the ends of the straggling branches of the cassava plants. This is a sign that the roots are ready for use. Again the work is done by the women. They cut down the cassava and the weed bush and dig up the roots, not all at once, but as they are required. Some short straight lengths of the stems of the cassava—sufficient to reproduce the number of plants which have been dug up—are cut and inserted in the ground as before and in the same spots.—"*Among the Indians of Guiana" by E. F. im Thurn, 1883, pp. 251-2.*

(*Annexure D.*)

DESCRIPTION OF THE PREPARATION OF CASSAVA ROOT FOR FOOD IN BRITISH GUIANA.

The one staple vegetable food of the Indians is afforded by the roots of the cassava plant (*Manihot utilissima*), which are made into bread, like oat cakes, by most of the tribes, into farine, a rough sort of meal, by others. No scene is more characteristic of Indian life than that of the women preparing cassava.

One woman squatting on her hams and armed with a big knife peels off the skin of the cassava roots which lie in a heap at her side. Each root, after being peeled, is washed and then thrown on to a new heap. A little way off another woman stands, and grasping one of the peeled roots with both hands scrapes it up and down an oblong board or grater studded with small fragments of stone and so roughened like a nutmeg-grater. One end of the grater stands in a trough on the ground, the other rests against the woman's knees. It is violent exercise. As the woman scrapes, her body swings down and up again from her hips. The rhythmic 'swish' caused by the scraping of the juicy root is the chief sound in the house; for the labour is too heavy to permit of talking. The cassava, which slips as pulp from the scraper into the trough, is collected and put into a long wicker woven matapie which hangs from the roof. This matapie or cassava squeezer is in principle exactly like the not uncommon toy known as a "Siamese Link." It is a cylinder seven or eight feet long and five or six inches in diameter made of closely woven strips of pliant bark. The upper end is open and has a loop by which the matapie may be suspended from one of the beams of the house; the lower end is closed, but it also has a loop, the use of which will presently appear. The cassava, saturated

with its highly poisonous juice, is now forced into the matapie: through the loop at the bottom of this a heavy pole is passed, one end of which is allowed to rest on the ground and is there fastened by means of a heavy stone or some such device, while the other is raised into the air. A woman now sits on the raised end of the pole, and her weight stretches the matapie downwards. In proportion as the length of the cylinder increases its diameter is of course reduced. The pressure thus applied to the cassava pulp immediately forces the poisonous juice out through the walls of the matapie. The juice drops down into a buck-pot which stands on the ground; and it is this when it is afterwards boiled becomes cassareep, a thick treacle-like liquid which is no longer poisonous, and the use of which in the manufacture of pepper-pot has already been described. Cassareep when but slightly boiled is sometimes eaten by itself and without further preparation; but if it is meant for pepper-pot it may either be used at once, or if boiled to a high degree of density, not for some considerable time. The cassava, now dry and free from juice, is taken from the matapie, broken into a sieve, and sifted so that it becomes a coarse flour. This is either wrapped in leaves and put away for future use, or is at once made into bread.

A large circular iron griddle or plate, of European manufacture, is now placed over the fire; by some of the remote Indians a flat slab of stone is used for this purpose, and there can be little doubt that this stone was originally universally used. On the griddle, whatever its material, a thin layer of the meal is spread. A woman, fan in hand, sits by the fire watching. With her fan she smooths the upper surface of the cake, and makes its edges round. In a very few minutes one side of the large, round, white cake is done; and when it has been turned, in yet a couple of minutes the bread is ready. When a sufficient number of these oatcake-like pieces of bread have been made, they are taken out of the house and thrown up on to the roof to dry in the sun. I have often admired, and vainly tried to imitate, the skill with which an Indian woman "quoits" up these large and thin cakes (which until they are well sun-dried are limp and flabby) on to the roof, often high above her head. When thoroughly sun-dried the bread is hard and crisp with a flavour like that of freshly-gathered nuts; in this state, if guarded from damp, it will keep for an indefinite time.

Not quite all the cassava meal, freed from juice by means of the matapie, passes through the sifter—a small residue, consisting of the more starchy matter, adheres together in particles too large to pass through the close woven wicker-work. This coarse, starchy residue, called by the Caribs *Emoo*, which is always small in quantity, is at once made into a cake, which differs from the ordinary cake made of the sifted meal in that, if eaten at once, it has a half gelatinous consistency and a pleasant subacid flavour; while, if it is allowed to become cold, it acquires a leathery consistency and is tasteless and uneatable.—"*Among the Indians of Guiana*" *by E. F. im Thurn, 1883, pp. 260-2.*

(*Annexure E.*)

CASSAVA AS FOOD.

Cassava seems to have a great tendency to extend the paunch, and to puff out the flesh and make the whole body look fat and round, without giving any real stamina, and as soon as it fails, even for a few days, the paunch hangs like an empty sack, and the fat disappearing, the skin hangs in folds, and every bone in the body becomes prominent.—"*Among the Indians of Guiana*" *by E. F. im Thurn, 1883, p. 264.*

PLANT SANITATION.

Entomological Notes.

By E. Ernest Green, *Government Entomologist.*

The cut ends of young Hevea stumps are frequently tunnelled by various small species of bees and wasps. But these insects are not responsible for the dying back. The pith of any dead stem would be utilized in a similar manner. When a Hevea plant is stumped, it usually dies back to the node, and it is in such dried ends that the tiny wasps construct their nests. They cannot be regarded as pests, but more properly as friends. For most of them provision their nests with Aphides taken from some other plant.

Specimens of a small Longicorn beetle, said to be responsible for the death of young Hevea trees, have been received from Southern India. The insect proves to be *Pterolophia annulata*, Chevr., a species that occurs in Ceylon also. I have no records of injury done by this insect to Para rubber in this country, but I have bred out a specimen from the diseased bark of a Ceara rubber tree. My correspondent from India reports that the beetles girdle the stems; the upper parts of the trees dying back down to the injured area. This girdling habit is common to many species of Longicorn beetles. The object of the manœuvre is believed to be to check the sap and induce the degree of decay best suited to the nourishment of the grubs of the beetle; the eggs having first been inserted in the bark above the point of injury. If this pest should become common, it might cause serious damage on rubber plantations. The accompanying figure of the beetle, represented about three times the natural size, may enable rubber planters to recognize a possible enemy. In case of any occurrence of the pest, the stems of all the trees should be carefully searched. The adult beetles will probably be found clinging to the bark of the trees, when they can be easily captured and destroyed.

Amongst other injurious beetles received during the past month are specimens of a beautiful burnished green Cetoniid "found eating the bark of a lemon tree," in the Kurunegala district; and a small green weevil (*Astycus* sp.) said to be defoliating Fig and Apricot trees. Against all such bark and leaf-eating insects, spraying with Paris Green will be found effective. When applied to foliage, it should be mixed with about six times its bulk of lime.

A small outbreak of a caterpillar pest (*Narosa conspersa*, Wlk.), on tea, has been reported from the Uda Pussellawa district. Though belonging to the family Limacodidae (which includes the notorious "nettle-grubs") this particular insect has not previously attracted attention as a pest. It does not figure in Watt & Mann's "Pests and Blights of the Tea Plant."

Another insect that has been sent in as a tea pest is the grub of a beetle (apparently a species of *Helops*). My correspondent reports that "these insects are killing out the tea in Teldeniya." Similar grubs were received from Talawakele, a few years ago. I believe these grubs to be merely feeding in decayed wood of stems that have died from other causes. Specimens of the stems received with the grubs have evidently been dead for many months.

In the number of this journal for June, 1905, I gave a list of plants affected by the "red borer" (*Zeuzera coffeae*). I have now to add to this list two speeies of Citraeeae,—the Orange (*Citrus aurantium*) and the "China Lime" (*Triphasia trifotiata*).

The outbreak of the "Arakkoddian worm" (*Spodoptera Mauritia*), noted in the December number of this journal, is reported to have abated.

A somewhat similar invasion of the "Army-worm" (*Leucania unipuncta*), on cultivated grass in Nuwara Eliya, has been effectively checked by the applieation of Paris Green.

The Superintendent of the Government Stock Garden reports that *Guizotia Abyssinica* (the source of Rantil Oil) proves to be very attractive to bees. Should this plant eome into gencral cultivation—as it gives promise of doing in India—the association of flower and insect should be of benefit to both apiculturists and growers of Guizotia.

Leaves of various plants have been recommended as available for food of the "Eri" silkworm, in place of those of Castor-oil. I find that the half or three-quarters grown worms are fairly complaisant in the matter of ehange of food; but for the newly-hatched worms the castor-oil plant remains a necessity. There seems little doubt but that the natural food of the worms is really the best for them. Those raised on other plants are nearly always stunted in growth and produce weak cocoons. If would-be cultivators of silkworms would exercise forethought and plant up small plots of ground with castor-oil, there would be no necessity for any change of diet. It is probable that castor-oil can be grown more economically than any other possible food plant.

The Government Entomologist of Natal asserts (Natal Agricultural Journal, August, 1905, p. 840) that "the malarial species of Anopheles breed, on the whole, in *moving* water. In no cases have the Anophelinae been found in *stagnant* water." This may possibly be eorrect as regards Natal, but it cannot be aceepted as a general rule. In the low country of Ceylon the stagnant tanks swarm with Anopheles larvae. I have taken larvae of *A. Witmori* plentifully from a tiny pool scarcely three feet in diameter. Mr. Theobald informs me that he has frequently collected the larvae from tubs of rain water in England. The swamps of the Roman Campagna are a notorious breeding place for one of the most deadly speeies of Anopheles.

I wish to draw attention to an omission in the description of the figures illustrating my notes in the November number of this journal. The two figures are designed to contrast the work of two different species of Tea mites. The deseription should read as follows:—

(*a.*) Tea leaves attacked by "Scarlet mite."
(*b.*) Do do "Yellow mite."

Mycological Notes.

BY T. PETCH.

A number of cases of "Brown Blight" have been reported recently. Some of these have been of the type known as "Marginal Corrosion" or "Rim Blight" in which the fungus first attacks the leaf at the tip or along a narrow band round the edge and later spreads towards the centre. These leaves usually bear the fungi of both Gray and Brown Blight, the latter producing spores in abundance, while the former is often only feebly developed and must be kept for some days in a damp

chamber before its characteristic three-tailed spores can be observed. Rim blight is supposed to be caused by the joint action of the two fungi; according to Watt and Mann it spreads far more rapidly than either Gray or Brown Blight alone. A careful watch should be kept for affected bushes and the diseased leaves should be gathered as soon as they are observed.

Two instances of injury following the tapping of *Hevea brasiliensis* are worthy of note since they appear to be due in some degree to the system of tapping adopted. In the first, the tree was eighteen inches in girth and was marked out by four vertical lines into longitudinal strips, each four and a half inches wide. The second girthed thirty-six inches and was similarly divided into six strips. In each case alternate strips were tapped by close-set V's, so close that the lower edge of one cut almost coincided with the parallel upper edge of the next; the intervening strips were to be tapped the following year. But on one untapped strip in the first tree and two on the second, the bark separated from the wood and consequently decayed. When tapping ceased there were left three strips of bark connected by thin V-shaped bars (like the coloured paper ornaments beloved of suburban land ladies), and the weakening of the tension over the tapped areas allowed the untapped bark to contract and split away from the wood. The undamaged strips were most probably on the shady side of the trees.

Specimens of decayed bark taken from the fork of a *Hevea* stem have been sent in under the impression that such decay is caused by the fungus of Hevea "Canker." The pieces of bark were united by a large clot of rubber, a fact which suggests that, possibly by the force of the wind on one branch, the bark had been ruptured at the fork; it is not usual to find a large flow of latex in cases of fungus injury, because the fungus advances slowly and dries up or destroys the cell contents as it proceeds. The decay of bark in such positions is generally due to the effect of rain water which constantly runs down the sloping trunks and over the fork. Examples of this are common on various trees in the Peradeniya Gardens; perhaps the best are those of *Duabanga moluccana* to the north of the cattle-sheds.

The question of Branch Canker in tea which received much attention last year has been in abeyance for some time awaiting the results of several inoculation experiments with the numerous fungi which have been found on the decayed branches. It is becoming more and more evident, however, that the decay which sets in from a pruning cut and runs down the branch is not due to fungi in the first instance, but is simply a "die-back" which should not occur on a vigorous bush. Branches on which these cankers have been completely healed have been sent in as examples of the effect of a properly balanced artificial manure. A recent visitor declared that these specimens were the most instructive examples of tea cultivation that he had seen in Ceylon. Whether the wounds on horizontal branches can be explained in a similar way is still undecided; as far as can be ascertained, no *Nectria* has yet been found either in Ceylon or India on these cankers.

Will correspondents please note that the letters O. H. M. S. do not secure the carriage of parcels free of charge to the Royal Botanic Gardens; and that specimens of diseases should be sent to the Gardens, not to the Experiment Station.

SCIENTIFIC AGRICULTURE.

The Liming of Soils.

THE USE OF LIME FOR IMPROVING SOILS.

The recognition of the agricultural value of certain forms of lime is not new, and it appears probable from the writings of Pliny that liming was practised by the Romans more than two thousand years ago. In England, Germany, France, and other European countries the application of lime in various forms has been and is still practised extensively. Dehérain states that certain regions of France have undergone a veritable agricultural transformation owing to the use of lime and marl. Müntz and Girard assert that more than one-fifth of the area of France is of granitic origin, and that when the soils are supplied with lime and phosphoric acid, which they lack, they undergo a complete transformation. In certain sections of Germany carbonate of lime in the form of marl plays an important part in maintaining the fertility of the soil. According to Wicke, the yields in certain districts of Germany have at times been quadrupled by the employment of marl, and many plants whose cultivation was previously impossible could be grown at a profit after the soil was limed. Schultz, of Lupitz, one of the most practical agriculturists of northern Germany, demonstrated the immense value of marl in developing the productiveness of the light soil of that section of Germany. By its use, in connection with abundant potash and phosphoric acid, he met success in growing leguminous plants which gather from the air large stores of nitrogen, thus making it possible by this addition of plant food and humus to cultivate the light soil at a profit. Haxton, in a prize essay "On light land and farming," mentions a number of siliceous sandy soils in various parts of England which are greatly benefited by liming, and in speaking of the granite formation in Scotland asserts that "the whole of the granite soils are deficient in lime, and the first step toward their improvement, after being drained, is to apply this substance in a hot or caustic state."

Ruffin is perhaps the most prominent of the earlier writers who called attention to the agricultural use of lime in the United States. As early as 1818, and later, in 1821, articles on the subject were contributed by him to the "American Farmer," and in 1832 appeared the first edition of his well-known work on "Calcareous manures." He cites many instances showing the benefit derived from calcium carbonate when applied in the form of marl to his own and other Virginia estates. In certain parts of Pennsylvania and New York lime has long been considered one of the essentials in wheat production. The beneficial effect of liming has been demonstrated in Alabama, Alaska, New Hampshire, Massachusetts, New York, Virginia, Maryland, Pennsylvania, Oregon, Illinois, and other parts of the United States, but, as Roberts states, probably 99 per cent of the arable soil of the United States has never been limed, and indeed many large areas are not in need of it. The work of the experiment stations, stimulated at the outset by that of Rhode Island, has now shown conclusively that soils which respond profitably to liming, either on account of their acid condition or of a deficiency of lime in other respects, are very widely distributed.

DIRECT MANURIAL ACTION OF LIME.

Authorities seem to agree that lime is necessary to the plant, and if it be wholly lacking in soils, even though an abundance of all the other essential elements is present, the plant cannot develop normally. The plant cannot grow

if any one of the essential elements of plant food is lacking. As already stated. lime has been found to be especially deficient in soils derived from granite. It is also often true of soils derived from mica-schist, sandstone, and from certain conglomerates, slates, and shales. Fortunately, however, many soils are well provided with lime by nature, and it is seldom or never necessary for those who cultivate them to resort to liming. It would be just as irrational to apply lime where it is not needed as to omit it where it is required, and hence arises the necessity of ascertaining the needs of particular soils in this respect. The method usually resorted to for ascertaining the amount of lime in soils is to treat them with some strong mineral acid (usually hydrochloric) and determine the amount of lime which is thus dissolved. Some writers state that if only one-half of one per cent is thus shown to be present, immediate resort to liming is desirable; others set the amount higher, and some seem to prefer to have present as much as one per cent. It is possible that a soil may contain considerable quantities of lime thus removable by acid, and yet in actual practice show much benefit from liming. As a matter of fact, soils of limestone origin sometimes show benefit from liming because sufficient carbonate of lime is not present in the soil.

This is due to the continual removal of carbonate of lime by crops and by leaching. Often some carbonate remains, but it is too much inclosed by other materials to be sufficiently active to prevent acidity and to insure the proper changes in the organic matter. The fact that beets of all kinds make a ready response to liming on soils which are deficient in carbonate of lime may be utilized as the basis for a practical and reliable method of testing the lime requirements of the soil. For this purpose lay out two plats of land, each about 12 by 30 feet, manure each of the plats with like amounts of a fertilizer containing potash, phosphoric acid, and nitrogen, and apply lime to one of the plats at the rate of from 1 to 2½ tons per acre (40 pounds per plat would be approximately 2½ tons per acre). A comparison of the growth and yields on the two plats will furnish a safe means of judging whether the soil will respond profitably to applications of lime. If the crop is helped but slightly by liming, most varieties of plants will not be in immediate need of lime. If the crop is greatly helped or is increased several times, it is likely that the soil is too much in need of lime to make complete success with most varieties of plants possible.

CHEMICAL ACTION OF LIME ON SOILS.

Lime is said to take the place of potash in certain chemical compounds which exist in soils, thus liberating the potash and placing it at the disposal of plants. In this particular, gypsum (land plaster or calcium sulphate) is believed to act more energetically than carbonate of lime, air-slaked or water-slaked (hydrated) lime. When soluble phosphates are applied to soils deficient in lime and magnesia the phosphoric acid combines with the iron and alumina of the soil to form compounds which are not readily utilized by plants. If, however, the soil is fairly well supplied with lime and magnesia this transformation is retarded, so that the plant is afforded an opportunity to utilize much of the phosphoric acid before it becomes unassimilable. If a soil containing a certain inert phosphate of iron is heavily limed, it is believed that this phosphate will be changed into a form which the plant can utilize. Lime may therefore not only aid in keeping recent applications of phosphoric acid in assimilable condition for a long time, but it may, if applied in sufficient quantity, help to unlock stores of phosphoric acid, in certain soils, which plants would otherwise be unable to use.

Hilgard has abundantly demonstrated the great value of gypsum (land plaster) in renovating "alkali" soils in the arid portions of the United States. Wherever too much sodium carbonate (black alkali) is the cause of the unproductive condition of the soil the gypsum reacts with it, producing sodium sulphate and carbonate of lime, whereby the alkalinity may be sufficiently reduced to render possible the profitable production of crops. In case protosulphate of iron and certain other poisonous compounds are present in soils, liming so changes them as to render them harmless to plants.

When the remains of plants undergo decay upon soils deficient in carbonates of lime and magnesia, acid or sour humus is liable to be produced, which is supposed to be particularly noxious to most agricultural plants, though apparently not detrimental to the growth of the cranberry, watermelon, rhododendron, azalea, and a few other herbaceous plants, trees, and shrubs. Such conditions are liable to occur even in upland and naturally well-drained soils. Liming is in all such cases an effectual and probably the most economical remedy.

PHYSICAL EFFECTS OF LIMING.

Many clay soils when wet by rains are not porous enough to allow the water to pass through them with sufficient rapidity, in consequence of which they become water-logged, and air which is necessary for the healthful development of plant roots within the soil is excluded. In times of drought, also, such soils cake readily, thus becoming more difficult to till and less adapted physically to the growth of plants. Liming is an effective preventive or remedy for all of these unfavourable conditions. Upon certain loamy soils containina considerable clay, liming often renders the surface more friable and less liable to form a crust upon drying. The improvement of drainage brought about by liming is one of the most effective means of preventing surface washing. When heavy rains occur on limed soils the water sinks into the soil instead of rush ing over the surface, carrying the fine soil particles with it and thus producing galls and washes.

Soils which are composed of siliceous sands are frequently benefited by being rendered more compact by liming. On such soils pulverized limestone is preferable to ground burnt lime, hydrated lime, or even air-slaked lime, owing to the more powerful action of the latter, and the best material to employ where it is obtainable is a clay marl containing a fair amount of carbonate of lime. The clay, as well as the lime, tends to materially improve the physical condition of the soil. It should also be the aim to increase the amount of organic matter in such soils by the use of muck and stable manures, or by the occasional plowing under of a green crop or of sward.

EFFECT OF LIME ON THE ACTION OF MICROSCOPIC ORGANISMS IN THE SOIL.

Many important changes are produced in the soil by organisms so small that they can only be observed by the aid of the most powerful microscopes. Some of the changes of this character in which lime plays an important part are the following :—

(1) The change of ammonia and of nitrogen in organic matter, such as blood, meat, fish, tankage, plants, etc., into nitrates, the form in which it is chiefly assimilated by most cultivated plants. This is known as the process of nitrification and is promoted by the presence of lime in soils.

(2) The decomposition of organic matter in muck and other soils. In this process the production of carbonic acid is much accelerated by the use of lime This carbonic acid in turn so acts upon inert plant food of the soil as to make

it more quickly available to plants. The indirect result, therefore, is to help the plant to draw more potash, phosphoric acid, etc., from the soil than would otherwise be possible.

(3) The utilization of atmospheric nitrogen by certain of the leguminous plants (notably the clovers), particularly upon sour soils, is facilitated by the application of lime.

LIMING SOMETIMES INJURIOUS.

Excessive amounts of lime, especially on light soils, may have an injurious action. This is particularly true of freshly slaked lime and of ground limestone upon light sandy soils, which are inclined to be dry and which contain only small amounts of organic matter. It hastens unduly the decomposition of organic matter, and thus renders the soil more open and less retentive of fertilizers and moisture than before. If either ground burned lime or slaked lime must be used upon such soils it should be applied in small amounts and at not too frequent intervals. As stated heretofore, clay marls are much better adapted than other forms of lime for the improvement of such soils. In lieu of such marl either wood ashes or lime which has been exposed to the action of the air for a long time is usually preferable to lime which has been recently prepared. Before the advent of "complete" fertilizers it was a common adage that liming "makes rich fathers and poor sons." If lime is used alone it serves to "liberate" potash, nitrogen, and sometimes phosphoric acid, and often the extra drain of increased crops on the soil leaves it finally in a worse condition than at the outset. In other cases the soil reverts after many years to its former state of unproductiveness, without appreciable injury. Continued success with lime can only be assured by the use of other essential manurial substances in connection with it. Few, if any, cases are on record where soils originally in need of lime have failed to continue to give good results from liming when care has been taken to maintain a proper supply of the other essential constituents and where lime has been applied in moderate amounts. There are impure limestones which after burning yield material that will harden like cement, and which on this account may have an injurious action upon the soil. If such limestone is pulverised without burning it is capable of yielding good results.

Dolomitic (magnesian) limestone contains widely varying percentages of magnesia and lime. Such stone if containing high percentages of magnesia may sometimes prove objectionable if used exclusively. Should injury arise from the accumulation of an undue amount of magnesia, this can be overcome by an application of ordinary lime. Rather than to use magnesian lime successively upon the same land it would be preferable to replace it frequently with lime containing little or no magnesia. Notwithstanding what has been said, the presence of some magnesia in lime is by no means objectionable, and it may, on certain soils, prove positively beneficial.

PLANTS BENEFITED BY LIMING.

The following are some of the plants which, in experiments on acid soil at the Rhode Island Agricultural Experiment Station, have shown marked benefit from the use of lime: Spinach, lettuce (all kinds), beets (all kinds). okra (gumbo), salsify (vegetable oyster), celery, onion, parsnip, cauliflower, cucumber, eggplant, cantelouple, asparagus, kohl-rabi, cabbage, dandelion, Swedish turnip, pepper, peanut, English or flat turnip, upland cress (pepper grass) martynia, rhubarb, common pea, pumpkin, summer squash (scalloped), golden wax bean, red valentine bean, horticultural pole bean, bush Lima bean, lentil, Hubbard squash, saltbush, hemp, tobacco, sorguhm, alfalfa, clover (red, white, crimson, and alsike), barley, emmer, wheat, oats, timothy, Kentucky bluegrass,

Canada pea, Cuthbert raspberry, gooseberry, currant (White Dutch), orange, quince, cherry, Burbank Japan plum, American linden, American elm, sweet alyssum, mignonette, nasturtium, balsam, pansy, poppy, and sweet pea. The crops were not only greater in many cases, but they were ready to be marketed much earlier where the soil had been limed. Tobacco not only made a better growth when limed, but the ash was much lighter in colour.

So far as concerns potatoes, the total crop is frequently not materially increased by liming, but the percentage of tubers of merchantable size is usually increased if the soil is quite acid, thus adding greatly to the total value of the crop. On account of the fact that liming increases the injury caused by potato "scab" care must be taken to treat the "seed" tubers with corrosive sublimate solution, formalin, or other fungicide* capable of destroying most of the germs of the disease before the tubers are planted. Furthermore, lime should be applied after the removal of the potato crop, except in case of land that has not been previously limed.

PLANTS BUT LITLE BENEFITED BY LIMING.

There are many plants which, when supplied with sufficient potash, phosphoric acid, and nitrogen in immediately assimilable combinations, such as nitrate of soda and nitrate of potash, show but little if any benefit from liming even upon quite acid soils. Among these plants are the following: Indian corn, spurry, rye, carrot, chicory, Rhode Island bent, and redtop. Upon a very acid soil some of these plants might show greater benefit from liming provided the nitrogen were supplied in sulphate of ammonia, blood, tankage, fish, cotton-seed meal, plant roots, or other nitrogenous substances, the decomposition and nitrification of which would be hastened by the presence of lime.

(To be Continued.)

The Agricultural Wants of Jaffna.

BY S. SABARATNAM.

Jaffna is an agricultural country, and the people have a reputation for their industrious and persevering character. This character is clearly seen in their agricultural pursuits, and the knowledge that they possess of the industry compares very favourably with that of any of their neighbours. The people do not of course have any systematic or scientific knowledge of agriculture, but they may be said to possess a good deal of practical knowledge worthy of being learnt by other people of Ceylon. In the selection of soils suited for different products, in the art of improving and manuring them, in the selection of manure for the different varieties, in the knowledge of the seasons best suited to grow the different crops, in the choice of crops to be cultivated in rotation, in the idea of the requirements of a plant at different stages; in short, in everything required in the cultivation of the products that are now grown in Jaffna, the Jaffnese may be said to possess ample knowledge that does great credit to them.

But it is not to be understood from this that they have nothing more to add to their knowledge, and that the ways and means adopted by them in the matter of agriculture are perfect. They have a good deal more to learn, and they have a great many wants to be supplied. Taking as they do a keen interest in the agricultural industry, the Jaffnese should be more forward than the rest of the Ceylonese in adopting measures that would advance the cause of agriculture. But it is to be regretted that such is not the actual state of things. The Jaffna

* For method of treatment see U.S. Dept. Agr., Farmers' Bul: 91.

man is very conservative in his ways; and it is very difficult to make him depart from his old stereotyped ways, and he has also great prejudices against anything new or strange.

The Agricultural Society would therefore confer a great boon on Jaffna if they could in the first place devise some means of infusing into the mind of the Jaffna man a tendency to view things liberally, and to give a trial to measures intended to improve the cause of agriculture. As he is, he will not adopt any new measure, unless he sees for himself the beneficial results of the same and is convinced of its advantage. He must therefore be shown by practical means the advantages of modern agricultural methods and of the introduction of new products suited to our climate and soil. I think experimental gardens at different centres would well serve this purpose, and if our headmen, all of whom are members of the Jaffna Agricultural Society, would take some interest in the matter and open up small gardens in one of their own lands in their respective divisions, they will do immense service to their country and to the cause of agriculture in particular.

I must, however, point out that the apathy of the Jaffna man to adopt most of the new methods proposed from time to time by modern agriculturists is not without some reason. They are either not suited to Jaffna, or are attended with difficulties too many to be surmounted. It would therefore be the duty of the Agricultural Society to advise the people how to get over such difficulties and to adopt such measures as are suited to Jaffna.

Irrigation.—The next subject that deserves the consideration of the Agricultural Society is the question of irrigation in Jaffna. Jaffna is comparatively a very dry place, and it depends for its water supply solely on its wells and "theeravoos." Water is drawn out in the case of wells by the laborious method of working well sweeps, and in the case of "theeravoos" by hand buckets or baskets. In working the well sweeps, not less than three people are put on the work, and at times the number increases to five. An equal, if not a still larger number of people is required to work in the case of "theeravoos"; and in either case the work involves a good deal of physical labour and waste of time and energy. Suggestions have often been made of pumps and other hydraulic machines or apparati; and some of them have been given a trial, too, but no success has been obtained in this direction. Any machinery introduced to help the Jaffna cultivator must be simple and cheap. The machines hitherto suggested are more costly than well sweeps, and this is a great obstacle in the way of any Jaffna cultivator availing himself of their use. The Jaffna cultivator is generally of limited means, and the extent cultivated or owned by him is very small. Costly machines are not therefore within his means, and even well-to-do people would hesitate to invest any money on such machines, as their working expenses greatly exceed those of the well sweep. The cost of working a well sweep would not exceed Rs. 1·12 a day, whereas the cost of working a pump, say a Noria, would come to Rs. 1·75 or Rs. 2 a day if such pumps are to be worked with bulls. Add to this the initial expenditure which is immensely larger than that of a well sweep, and the total expenditure would certainly be prohibitive and disadvantageous. I say disadvantageous because there is not much difference between the quantity of water raised by a well sweep and that by an ordinary well pump, while the cost and working expenses of a well pump are much larger than those of a well sweep. But if the pumps could be worked on a large scale, they would certainly be found to be of great advantage; but I am afraid that our wells would not permit this. They do not hold ample water to justify their working with large pumps, and I think that this difficulty could be overcome

if our wells were sunk deeper and broader, enough to contain a large column of water. If this is done, the necessity of having small wells, as we have now, in each garden may be dispensed with, and we may have one well in common to a group of gardens which may be supplied with the necessary water from that well by means of a pump. It is for the leaders of our community or the large proprietors of our place to come forward and sink such a large well similar to the one lately sunk or enlarged by Government at Udumpirai, and work it with a large pump and show the people the advantage of mechanical labour. If the people are convinced of the advantage by practical demonstration, the cultivators of limited means may jointly sink a well in common to several of their gardens and work it with a pump and enjoy the benefit of it.

If this cannot be done, a simple machine that could be removed from one well to another and worked at a comparatively small expenditure should be introduced, and I hope the Agricultural Society will interest itself in this matter.

I would in this connection draw the attention of the enterprising men of our place to the Udumpirai well which was enlarged by Government in connection with the proposed water supply to the Jaffna town, and which proposal now seems to have been given up. Would it not be worth the while of some of our enlightened countrymen to form at least a Joint Stock Company, if none of them are able to do it individually, and buy this well, insert a large pump in it, and supply the adjoining gardens with the necessary water and recover a rate for the supply?

Such a pump can be very well put on the inexhaustible Puttoor well and gardens could be supplied with water by means of channels cut for the purpose. I think even the tracts of fields close to this well could be supplied with water from this well; and this, I think, is a question worthy of consideration by the Government also. Government expends large amounts of money on irrigation works in the mainland, but nothing has yet been done in the dry peninsula. If they could raise the water of this well by powerful machinery and supply the tracts of fields below it by means of channels, the owners of these tracts would be exceedingly glad and willingly pay even an enhanced water rate.

Labour.—Another subject that deserves the consideration of the Agricultural Society is the supply of labour. Labour in Jaffna has become very dear, and this, I should think, is the chief reason why paddy cultivation does not pay in Jaffna. I read in an Indian Magazine that agricultural labour in India costs about 12 cents a day, while in Jaffna it has gone up to 37½ cents, and occasionally 50 cents a day. It is no wonder that the cultivation of paddy in Jaffna does not pay. It is very essential that the labour market should be amply replenished, and if only sufficient inducement could be offered to the Indian coolies, they are sure to be attracted to Jaffna in large numbers and materially advance the cause of local agriculture.

Cattle-Breeding.—It is generally admitted on all hands that agriculture depends a good deal on the stock of cattle of any place. Manuring and ploughing are two important and indispensable factors in the matter of agriculture, and these cannot be effected without a sufficient and good stock of cattle. The cattle are again required by us for thrashing our paddy stacks, and they are also immensely useful to us in the supply of milk and in serving us for draught purposes. But the stock that we have now are miserably poor; and we send large sums of money annually to India for the purchase of draught bulls. The bulls engaged in ploughing our fields are a miserable lot, and the

work turned out with these bulls is only a scraping of the surface. Suggestions for using better ploughs were very often made to the cultivators, but their excuse—and a good excuse it is—was that such ploughs would be too big for their bulls. It is therefore essentially necessary that we should improve our live stock; and this cannot be done unless we grow substantial fodder for our cattle. The pasture lands that we have now are liberally scorched up in the dry weather, and our cattle may be seen to roam about the roadsides in search of any bit of green thing that they can have a bite on. A fodder plant for Jaffna is one of her chief agricultural wants, and if this want could be supplied the breed of our cattle could be considerably improved and a further advance could be made in agriculture.

IMPROVEMENT OF THE EXISTING AGRICULTURAL PRODUCTS.

Though there are several products that are now grown in Jaffna, those extensively cultivated are only three, viz., paddy, coconut and tobacco; maniocca may also be said to have risen to importance since some time back. Paddy is cultivated in the most primitive way, and there is ample room to improve the operations connected therewith. Turning of the soil or ploughing is done at present only as a matter of time-honoured practise, and little or no attention is paid to the choice of seed paddy. A good deal of the works connected with ploughing, sowing, harvesting and thrashing could be considerably simplified by mechanical labour, and no attempt has yet been made to improve the existing methods in this direction. Complaints have very often been made of the decrease in the annual rainfall, but the Jaffna culivator does not know what to do to suit the altered condition of nature. Either a kind of paddy that would mature with a smaller quantity of rainfall must be chosen for the seed, or some other measure should be adopted to make good the deficient rainfall. These are subjects for the consideration of and enquiry by enlightened and intelligent persons interested in agriculture and scientific researches.

Tobacco.—Tobacco and coconuts are the only two items of Jaffna produce that bring any foreign money into the peninsula. The former of these, viz., Tobacco has been grown and cured chiefly to suit the Indian market, but competition from other places has considerably reduced the demand for Jaffna tobacco.

This competition has greatly affected Jaffna, and it is highly essential that other markets should be found for the Jaffna tobacco. The present mode of curing the Jaffna leaves renders them quite unfit for European markets, and the varieties now grown in Jaffna are not very much to the taste of foreign markets. The services of an expert in the art of Tobacco growing and curing would be highly beneficial to the Jaffna tobacco industry, and I hope that the local Agricultural Society will take some interest in the matter.

Maniocca Cultivation.—This cultivation has considerably increased, and now holds a prominent position in the food supply of Jaffna. This is generally characterised by the name of Panjen-Thangi "or famine preventative," and it is not an exaggeration to say that if not for the maniocca roots, Jaffna would very often have been a victim to the scarcity and famine that would otherwise have followed the failure of our paddy crops on different occasions.

The soil of Jaffna admirably suits the cultivation of this crop, and it is a matter for serious consideration whether it would not be possible to extend the cultivation to a still larger extent and export it to other places in the shape of flour turned out of it.

Extension of other Cultivations.—In addition to the above, we grow different kinds of vegetables, roots, yams, chillies, grapes, mangoes, and various other crops which would find a ready market in other places in Ceylon and elsewhere. Now that

we are given a railway, we have an easy and speedy means of transport, and there is always a great demand for Jaffna products in preference to those of other places. Why should not then the existing extent of the cultivation of these products be sufficiently extended to meet our own demands and send the surplus to other places. Would it not be worth the while of any of our enterprising agricultural adventurers to open up fruit and vegetable gardens at populous centres and send things to the neighbouring towns and villages.

New Products.—As I have shown before, the Jaffna cultivator is very conservative in his ways, and he is always very reluctant to give a trial to any new product. This is a sad mistake. We read of marvellous results obtained in other places by the cultivation of such plants as rubber, cotton, vanilla and other products, which there is ample reason to believe will well suit the Jaffna soil. Tobacco and maniocca were themselves new products to Jaffna at one time, and to-day we see the beneficial results of the introduction into Jaffna of these products by some of our energetic and far-sighted forefathers. Other new products also could be introduced with equal, if not better, advantage, and the subject only needs a venture by some of our enterprising countrymen. The advantage should only be shown once, and the cultivation is sure to be taken up by the mass at large. It is for public bodies such as the Agricultural Society to infuse into the minds of the general public the manifold advantages of the introduction of new products suited to Jaffna, and this knowledge could be imparted by leaflets published at frequent intervals, by experimental gardens and by agricultural shows held periodically.

Agricultural Banks.—I know that our cultivators undergo great hardships at times for want of funds to carry on their work. Tobacco cultivators are often found to borrow money on an interest at the rate of two per ten for a period of six or seven months. Paddy cultivators suffer from want of seed paddy and the necssary funds to manure, sow, weed and harvest their fields at the proper time. An agricultural bank is a great desideratum to Jaffna, and the Agricultural Society would confer a great boon on the Jaffna public if they could find their way to have an institution of the kind opened in Jaffna.

Agricultural Instruction.—The Jaffna cultivator has of course some practical knowledge of agriculture, but he has no idea of the industry in a scientific manner. He knows what to do to grow a certain crop, but he does not know the reason for adopting the course that he follows. If he knew the reason he could do the work much better, and he might not meet with occasional failures as he does now. Our young generation should at least be given some instruction on the subject, so that it may be of great value to them when they attain manhood, and I think it is not a bad suggestion that the Director of Public Instruction should be moved to make agriculture one of the curriculum of studies in Grant-in-aid and Government schools. Agriculture is certainly a more useful study than Latin and Greek, or Geometry and Algebra.

Agriculture in the Mainland.—Though the remarks I have made in this paper are intended chiefly for the Jaffna Peninsula, I should say that they could apply with double force to the mainland of the Jaffna district and to the Province in general. We have ample scope to carry on cultivation in the mainland where we have different kinds of soil and several tanks to facilitate our work. The people who inhabit that part of the country at present, the Vanni people as they are generally called, are a set of lazy people, and their idea of cultivation is paddy and paddy alone. They direct their attention but little to any other cultivation, and their idea of the duties of a cultivator is very peculiar. They think it beneath their dignity to work on their tank bunds, and the little they get in their fields is usually sucked by the Karativu money lender and cooly. When their paddy crop is reaped they think that their work is over, and they may then be seen idling their time with a pack of cards

or other pastime. Any suggestion offered to them in the shape of agricultural improvement is viewed by them with scorn and indifference. They are indeed a very backward race, and their condition is very often a pitiable one. All their various wants are met with paddy, and paddy is their " what not." All their necessaries of life such as clothes, curry stuffs, oil, furniture, cooking utensils and even their betel and arecanut are bartered for paddy, and it is no wonder that they exhaust their stock within a few months, and they have recourse to the jungle in search of game and honey to appease their hunger.

The enterprising Jaffna man should find his way into the Vanni and shew his brethren there the way to be benefitted by agriculture. The peninsula is over-populated, and the scope for cultivators there is very limited. It will therefore be in the interests of the Jaffna man, too, that he finds his way into the mainland where by benefitting himself he may benefit the Vanni cultivator also. I should, however, point out that the Vanni cultivator is not without his own disadvantage to contend against. He has to work in an unhealthy climate, he has to contend against wild beasts, he has to work on his tanks and on his village clearings, he has to fence his fields and keep watch over them at nights, none of which works the Jaffna cultivator has. He has not again an insured water supply as the Jaffna man has in his wells. It is true that he has tanks which depend wholly on a good rainfall, and if this fails his tanks also and his cultivation stops. The wells in the Vanni are not so successful as those in the Peninsula.

But the Jaffna man I am sure will find his way to remedy these evils. He will make a careful use of the water in the tank and will greatly avail himself of the rain water which the Vanni cultivator does not in the least make any use of. The Vanni man would not endeavour to supplement his water supply with wells, whereas the Jaffna man would be always forward to make experiments and have always a good supply of water at his command. It is therefore very essential that if the agricultural operations in the North are to be extended, the congested population of the peninsula should be made to move towards the mainland.

HORTICULTURE.

Seasonal Notes for February.

By H. F. Macmillan.

(Illustrated.)

Rainfall averages in inches.—Peradeniya 1·59, Colombo 2·08, Ratnapura 4·60, Galle 3·02, Trincomalee 2·26, Jaffna 1·31, Anuradhapura 1·47.

The dry season has come round again and with it the need for much watering and due shading of all tender plants which are out of doors. Methods of preservation rather than cultivation must now be the main consideration in regard to most garden plants. Especially young palms, Crotons, Acalyphas, Dracaenas and such like should be judiciously shaded during the dry hot months, cadjan leaves being the best (because the most durable) for the purpose. In the flower garden little can be done beyond watering, stirring the surface soil frequently, and supporting delicate plants with neat stakes properly concealed by the foliage. But this does not by any means imply that work is at a standstill, or that less labour than usual is required.

Of ornamental plants generally those grown in pots and known as "Pot-plants" claim special attention at this season. Although these do not generally speaking contribute to the needs of mankind in food, medicine, or wearing fabrics, they have a material influence upon the domestic comforts of life. The taste for ornamental plants and flowers is an essential feature of the progress of civilisation. Decorative plants are thus regarded as an indispensable part of the furnishing of a house, and no home is considered complete without some homely pot-plants. These are of two kinds, some being grown for their foliage and others for their flowers. As a rule the former are easier to grow than the latter, and consequently in many gardens flowering plants in pots are comparatively scarce. One important reason for this is that the conditions which best suit "foliage-plants" are not adapted to "flowering-plants," the latter as a rule requiring more sun than the former.

To attain the maximum of cultivation probably hardly any two kinds of plants require exactly the same treatment in every particular. General rules may however be followed with advantage, but success is in proportion to the interest and trouble taken in the subject. The soil, drainage, and watering are the points of principal importance. Leaf-mould is usually regarded as an indispensable ingredient in the preparation of potting composts, being used in the proportion of $\frac{1}{4}$ to $\frac{1}{2}$ with loamy soil and well-decayed manure, about $\frac{1}{6}$ to $\frac{1}{8}$ fine sand being thrown in to give porosity to the mixture. A sprinkling of broken charcoal in the mixture has invariably a beneficial effect. In Colombo both leaf-mould and loam are practically unknown, but very fair potting mixtures can nevertheless be made up with decayed and chopped coconut fibre mixed with old and dried manure and road scrapings. Perfect drainage for pot plants is absolutely essential. A layer of moss, leaves or fibre should always be placed on top of the drainage before placing the soil in the pot; otherwise the pulverized soil soon clogs the drainage, and the result is impaired health of the plant and the need for another repotting. Always water sparingly and shade plants well after repotting, treating them really as invalids until they begin to throw out young rootlets and show signs of fresh growth.

PLATE I. *Photo by H. F. Macmillan.*

ORNAMENTAL GROUPING OF PLANTS AT THE ROYAL BOTANIC GARDENS, PERADENIYA.

1. Agave Americana variegata.
2. Coleus var.
3. Caladium Ville d'Hambourg.
4. Caladium Humboldtii.
5. Chrysalidocarpus lutescens (Palm)
6. Dracaena (Cordyline) var.

FLOWERS IN SEASON.—The number of flowers in season is rather limited. Very striking, however, is *Spathodea campanulata*, which might well be called the "Flame tree" on account of the large scarlet flowers which literally cover the tree and make it conspicuous at a considerable distance. It is called the "Coral tree" by some people in want of a better name, but "Spathodea" is a simple and easy name to remember. The tree is a native of tropical Africa. *Peltophorum ferrugineum*, a native of Ceylon, is one of the most showy and ornamental of trees. It is now in full flower, its large masses of bright yellow blossoms being in pleasing contrast with the fine pinnate leaves. *Roupellia grata*, the "Cream Fruit" of Sierra Leone, is also now in full bloom. The flowers are borne in dense sessile (*i.e.*, not stalked) cymes, being of a pink or pale rose colour, and very fragant. The name *grata* means "agreeably-scented," but the appellation "Cream Fruit" is difficult to explain, unless it is on account of the white soft but scanty pulp of the fruit, which is scarcely edible.

Seasonal Gardening Notes for the Hill Districts.

BY J. K. NOCK.

FLOWER GARDEN.—The weather during February is usually dry and watering demands a great deal of labour. The bulk of annuals are now in flower and present a gay appearance. They had best be watered in the evenings, and if weak liquid manure is given every fifth morning the growth will be greatly enhanced and fine blooms may be expected. Peg down Phloxes, Verbenas, Petunias, &c.

Seedling Carnations about to bloom will need support and should be staked neatly. Advantage of the fine weather should be taken to cut out Loranthus parasite from the large trees, and to clear up accumulated rubbish, burning the branches and anything that will not readily rot. Repair arches, arbours, and culverts, thatch sheds, clip hedges, trim shrubs, and paint the wood work of glass houses, gates, &c. Roses to bloom in April may be pruned now, and when new growth appears mulch with rotten manure or *steamed* bone dust.

Wistaria chinensis.—This hardy creeper native to China with purplish flowers is now in bloom and the object of much admiration. The plant was pruned in November, and it is hoped shortly to have rooted cuttings available for distribution.

Sanvitalia procumbens.—This hardy annual with pretty yellow flowers has been introduced to Hakgala and will be found suitable for edgings.

Cacazia coccinea, another new plant from Sutton & Sons bearing orange-scarlet flowers on long stems is a welcome additional hardy annual for the flower garden.

Layia elegans and *Rhodanthe* are flowering well and can be recommended to anyone wishing to get something new. The latter are very attractive when massed in beds.

VEGETABLE GARDEN.—Brussels Sprouts, *Brassica oleracea bullata gemmifera*, belonging to the Natural Order Cruciferæ. This is one of the finest and most relished English vegetables, and can be grown practically all the year round, taking exception, to a certain extent, only to the worst months of the South-West Monsoon. Seeds should be sown in sheds, and the seedlings pricked out,

six inches apart into open beds, when large enough. Up to this stage the soil should be only light and ordinary, the object being to produce sturdy plants without over luxuriant growth. Transfer into their permanent situations two feet apart each way before they overcrowd each other, *i.e.*, when they have made about six leaves. The soil they are finally planted into should be limed (with unslaked coral lime freshly burnt) and liberally dressed with somewhat fresh manure. The main point to attain success is a long growing period, so the plants should not be forced on too much. "Buttons" will form from the soil level to the top. The best time to take the sprouts is before a leaf has unfolded. When all the sprouts are gone the top cabbage may be cooked as a vegetable if worth it.

LIVE STOCK.

Poultry Notes.

By G. W. Sturgess, M.R.C.V.S.

DISEASES OF POULTRY.

General.—There is little necessity to point out what the common indications of good health are, as most poultry keepers know when their birds are healthy or at least soon recognise any departure from the normal. There is one point in connection with the temperature which calls for passing notice. The normal temperature of the fowl is very high, namely, 107 F. compared with 101 F. to 102 F. in the horse and ox. Any one taking the temperature of a fowl might consider such a high temperature as indicating a very feverish condition when it is not so.

In connection with poultry diseases of an infectious nature, as in the case of similar diseases in other animals, it is important to bear in mind "*isolation*" of sick birds and "*disinfection*" of houses, nests and runs. Excepting wounds, fractures and similar complaints, in all cases a sick fowl should be taken away from its companions and kept in a separate box until it recovers or dies. The house and run should be cleaned and disinfected. The house may be cleaned out with a solution of a disinfectant such as Carbolic acid, Jeye's Fluid, Sanitas or similar preparations in water and then limewashed. The wood work, perches, &c. may be given a coat of hot gastar, the ground of the run dug over, food boxes and water troughs cleaned and scalded, nests burned and new ones supplied.

If ground permits it is better to give a fresh run altogether. These or similar measures are indicated in the case of a very infectious disease which should be suspected when two or three birds die one after the other showing similar symptoms.

Accidents.—*Broken Leg.*—A fractured leg is generally caused by a blow from a stick or stone, or caused by rat traps, &c. If the fracture is in a thick part of the leg close to the body treatment is difficult, but fracture of the shank bone which is easily accessible can be successfully treated. The bone should be put into the proper position, care being taken to see the foot is straight and narrow splints of leather (wetted before application to make it pliable) or thin wood applied and the leg bandaged with a linen or calico bandage soaked in boiled starch or covered with plaster of Paris and water layer by layer while bandaging, either of which will when dry be quite hard and firm. The bird should be kept fairly quiet, and in about ten days or a fortnight if all goes well it begins to use the leg again. The bandage and splints may then be removed, and only a bandage applied without splints, and removed after a few days when the leg becomes strong. Care must be taken not to bandage too tightly to cut the leg or to stop the circulation. If the toes swell the bandage must be loosened.

Broken Wing.—This is more difficult to treat. The wing should be tied down to the body in the natural position and the bird confined in a comfortable cage without a perch. If the flesh is broken the wound must be treated and protected from flies.

Wounds.—Under this heading may be classed the injuries to the comb or wattles by fighting, especially as commonly occurs with wire netting between the combatants. Wounds should be gently cleaned with cold water and dried with cotton wool and a greasy or oily dressing used. Benzoated lard is excellent for all kinds of wounds on poultry. Zinc ointment or Boric acid ointment may be used if desired. It is a great mistake to apply drying lotions which cause the wounded tissues to become hard and leathery and prevent healing.

Wounds of the Eye may be gently cleaned daily with warm water in which a little Boracic acid is dissolved (about as much as will lay on a ten cent piece to a wineglassful of water) and the following lotion used after it:—

Tinct. Belladonna 10 or 15 drops.

Goulard's extract of lead 10 or 15 drops.

Water 1 ounce.

Mixed.

If necessary tie the legs to prevent scratching the eye. A little benzoated lard may be used outside round the eyelids.

Wounds of the Feet must be well cleaned, and any thorns or bits of glass removed. Benzoated lard can be applied and the wound bound up with soft rag. The dressing should be done daily. Any matter, or a kind of waxy material which commonly forms, should be removed daily before the dressings are applied.

(*To be continued.*)

THE GUINEA FOWL.

The Guinea Fowl is more generally kept for ornament than as a utility fowl, and its merits for the latter purpose are apt to be lost sight of. It is, however, one of the most active foragers of all birds that can be kept on a farm, and the cost of keeping it, compared with other kinds of poultry, is small. The gross profits which it yields may not be as large as those from fowls, ducks, or turkeys, but the net profits are not unsatisfactory, as it is largely self-supporting.

It is particularly hardy, and generally sleeps in the trees about a farmyard rather than in a house. In this way it is free from restraint, and is able to spend the early hours of the morning in foraging for food. There is no better gleaner than the guinea fowl, and it will wander as much as a mile from home, but as it is chiefly insectivorous it does scarcely any damage to crops, and the benefits which it confers by ridding the fields of insect pests undoubtedly outweigh any slight injury caused in this way. It is well able to take care of itself, and there is little danger of its being killed by a fox, while its homing instinct is well developed, and it may be relied upon to come home to roost at night. The guinea fowl, therefore, requires little of the care and special management that must necessarily be given to other domestic poultry, as, if given free range, it will during the summer find almost all the food it requires.

Egg Laying.—Guinea fowls do not lay in the winter, but during spring, summer, and autumn they lay a number of eggs. Starting, as a general rule, in April, they lay without intermission daily for perhaps a month, and if the eggs are removed from the nest as they are laid the hens will continue for perhaps three months without becoming broody. If they remain in the nest and want to sit, it is only necessary to take away the nest-eggs and break up the nest, and within a week the hen will start to lay again in another place. Even the tamest birds seem to dislike laying indoors, and it is almost impossible to induce them to lay

in hand-made nests. They prefer to make their own nests in secluded places, where they are well screened from view by bushes or weeds. So cleverly is the nest concealed that it is sometimes difficult to find, but when leaving the nest the hen utters a long and peculiar cry, which is not heard at any other time, and by this means the whereabouts of the nest can be located.

It has been stated that the guinea cock is monogamous, but this is not strictly correct, though in order to secure fertile eggs it is best to keep equal numbers of cocks and hens. If there are many eggs in a nest at the time it is discovered they should be taken away a few at a time, for whilst the guinea hen may not be able to count, she can see the difference in the nest if, say, a dozen eggs are taken away at once and only one or two left as nest-eggs. But if the number is gradually reduced from a dozen or a score to one or two the difference is not detected, and the hen does not forsake the nest. The hen will desert the nest, however, if it is considerably disturbed, or if the surrounding weeds or bushes are trampled.

The eggs are about two-thirds the size of the ordinary hen's egg, but of excellent flavour. It is important, however, that they should be fresh, as contact with the earth or grass in a nest will after some days give them a most objectionable taste; it is therefore necessary to gather the eggs daily.

HATCHING.—The eggs take from twenty-six to twenty-eight days to hatch, and as it is desirable to have the chicks hatched as early in the year as possible, it is advisable to set the eggs under ordinary hens. If the guinea hen hatches her first nest of eggs she will not lay again for the season, but she may be kept laying to September, or later, by preventing her from hatching. It is then too late to hatch guinea eggs, for late hatched chicks will seldom live through the winter, and even if they should survive they remain small and of little use for marketing in February or March, which is the season for guinea fowls. A barn-door hen of average size can hatch about twenty eggs, and when the chicks are hatched their foster-mother cares for them in a more satisfactory manner than the guinea hen would, for the common hen is more tractable, and can be kept with her brood in a limited space.

CARE OF THE CHICKS.—The chicks leave the shell very soon after the appearance of the first chip, and almost immediately they are inclined to stray. In this way some may be lost unless a close nest-box is provided. For the same reason it is necessary to attach a closely-wired run to the coop, in which the chicks are put after they are hatched. For rearing the chicks a combined coop and run has been found most convenient. This may be cheaply made of boards and wire netting about 5 ft. long, 2½ ft. wide, and 2 ft. high. This should be divided into two parts, making a coop or sleeping compartment 2½ ft. by 2 ft., and a run of 2½ ft. by 3 ft. The sides of the run may be of ½-inch wire netting, the sides of the coop being closely boarded. A slatted partition should divide the two sections, the whole being covered by a span roof of thin boards.

FEEDING THE CHICKS.—The chicks may be left in the nest until they are about twenty-four hours old, and they can then be removed to the coop and fed for the first time. Owing to their liability to stray, the chicks must be kept within the confines of the coop and run until they become accustomed to the mother's call, but afterwards they may be given more liberty. When newly hatched the chicks may be fed on any patent chicken meal, moistened with milk and raw whipped eggs. They should also get green food from the start, and the best kind is chopped onions or leeks, but lettuce, dandelion, &c., may also be used to advantage. When the chicks are a few days old plainer foods may be freely used, and one of the most wholesome is coarse oatmeal fed dry. This may be varied by the occasional use of

boiled rice, raw rice meal, hemp seed, millet seed, &c. At a later stage, say when three or four weeks old, some middlings and fine barley-meal may be added to the mash. Grit of fine quality must be regularly supplied from the time the chicks leave the shell.

VALUE OF INSECT FOOD.—There is nothing so wholesome for the chicks as insect food. Dried ants and ants' eggs are often used by those who rear pheasants and guinea fowls, but in many districts, especially where the soil is sandy, there are ant-hills in the fields. In such farms it is only necessary to place the coop in which they are kept near an ant-hill. and the chicks will feed greedily on the insects and their eggs. It is worth while to have a light coop with a wire bottom made, and the hen and chicks can be placed in this and laid over an ant-hill which has previously been stirred up and levelled with a spade.

Young guinea fowls are naturally insectivorous, and when hatched out in the woods and fields they live very largely on flies, grasshoppers, moths, and grubs of all kinds. These being their natural foods, the more of them that can be given to the chicks in a state of domestication the healthier they will be. It is therefore advisable that when a few weeks old the chicks should be given a free run with the old hen, and the best kind of range for them is an overgrown, weed-covered garden, orchard, or shrubbery. In such a place they can find as much insect food as they need to keep them in health; but if the run is small, or if too many birds are kept on it, it becomes necessary to feed guinea chicks with a small quantity of meat in their mash. One of the prepared meat foods or finely-chopped fresh meat and fresh bone may be used.

For table use guinea fowls are but little inferior to the pheasant. The flesh is somewhat dark, but has a decided gamey flavour, and is appreciated when game is out of season.—*The Journal of the Board of Agriculture, Vol. XII, No. 9, December, 1905, pp. 533/6.*

Apiculture.

AGE AT WHICH BEES FIRST CARRY POLLEN.

Referring to the alleged proof that bees five days old carried in pollen, Mr. Samuel Suddaby expresses doubt as to the completeness of the proof, and raises the question whether it is not possible that the pollen-carrying bees might not have come from elsewhere. The doubt is legitimate, and the question entirely fair. Moreover, there are general principles involved of which at least the younger readers may be ignorant, and of which it is sometimes very important they should be informed; so I am glad of the opportunity to give the matter a somewhat full discussion. Mr. S. asks, "Was it impossible for bees to get into that hive?" I feel warranted in saying that, for the first five days, it was impossible for any bee to enter from the outside. It was closed bee-tight. The hive was placed over another hive containing a full colony, the upper hive having a solid bottom nailed to it (years ago my hives had bottoms nailed on), and in that bottom was a two-inch hole to allow the heat to pass up from below. To prevent passage of the bees, wire cloth was nailed over the hole above; and, to prevent any communication through the wire cloth, another piece of wire cloth was nailed over the hole on the under side. Then Mr. S. suggests the possibility that, when the hive was opened at the end of the five days, the bees entering with pollen may have been bees from other colonies, citing this special instance: "Last year I got an Italian queen and put her in one of my hives; and before the summer was over I saw Italian bees in at least two hives other than the one in which I put the queen. They appeared to be working the same as the other bees in the hive."

It is quite true that sometimes perhaps it should be said oftentimes—bees enter the wrong hive on returning from the field, and being well laden, they are kindly received and given their naturalisation papers. A homeward-bound bee, heavily laden, and wearied with its long flight, may be beaten to the ground in front of some hive other than its own. Without rising on its wings to take its bearings it crawls directly into the hive, and without further ado is adopted as one of the family. Put twenty hives in a straight row, six feet apart—ten feet if you like—on a level prairie with never a tree or other landmark except the hives themselves, and you may expect no little mixing. Bees are not good enough at figures to tell for certain whether their hive is the ninth or tenth from the end of the row, and so a bee may go ten feet out of its way to enter the wrong hive.

Paradoxical as it may sound, the same bee that would make a mistake of ten feet cannot be induced to make a mistake of six inches under the right circumstances. In early spring, before bees have flown, close the entrance of an eight-frame hive all but three or four inches at the right end. After the bees have been flying busily for two or three weeks close the right end, and allow three or four inches opening at the left end. The bees, upon returning from the field, will go straight to the closed right end, taking quite a while to find the opening at the left end, and it will be days before they stop going first to the right end. You see, the bees go by looks, without carefully measuring distances. The bee may go to a wrong hive ten feet away because it looks just like its own; but it will not enter an opening only six inches distant at the other end of the hive entrance, because the left end doesn't look like the right end.

Well, of what practical value is all this? For one thing, the man who fully understands that it is not uncommon for bees to enter wrong hives will not hastily condemn as impure an Italian queen because he finds in her hive a few black or hybrid bees that have come from other hives. For another thing, a proper understanding of the matters that have been mentioned will allow us to increase the number of colonies on the same ground without increasing the danger of bees entering wrong hives. Take that row of twenty hives previously mentioned, and somewhere near the middle of the row set a tree or a fence-post in front of the hives, or even behind them. A hive at the right of the post will not look like a hive at the left; neither will the second hive at one side of the post look like the first or third. In my time I have used a good many double hives—a bee-tight partition in the centre, with both entrances in front. Although the entrances were not six inches apart, I never had occasion to believe that a young queen on her return from her wedding-excursion ever entered the wrong side.

Again, a proper understanding will allow us so to place our hives as to double the number on the same surface of ground. Take again that row of 20 hives at equal distances. By the side of each hive in the row, and close up to it, you can set down another hive, doubling the number of hives in the row, and there will be no more danger of the bees mixing than there was before. A bee belonging to No. 14 is more likely to get into No. 12 or No. 16 than to get into No. 13, which is nearest to it.

Let us now turn to the question at issue. The queen was fastened in the hive, with no bees except those in the cells. No bee could enter from outside till the hive was opened at the expiration of the five days. A worker-bee from elsewhere, beaten to the ground by the wind, would not crawl into this hive just opened, but would crawl into the hive under it, standing on the ground. A worker from the hive below, on returning from the field, would not make the mistake of entering a place looking so unlike its regular entrance. Still less would a bee from any other hive make such a mistake, unless there

was standing near by an entrance to a second storey, and nothing of the kind was there. Even supposing it possible that a bee might mistake this upper entrance for its own lower entrance, would it be likely that, within an hour, there would be a number of bees from elsewhere carrying pollen into a place where not a bee had before been flying? Moreover, the appearance of the bees was not that of old bees, but of bees only a few days old.

Cattle.

DEHORNING CALVES.

Working cattle and milch cows should be dehorned when quite young, for the horns are of no use and merely a possible source of trouble. On this subject a writer in a recent number of "Hoard's Dairyman" gives the following advice. He says :—

"The best way to dehorn is the day the calf is dropped. Let the calf suck its dam all it wants, and then the calf will lie down and sleep soundly, and you can go to it and hunt for the little button on its head where the horn will start. There you can find a little spot that has no hair, and you just rub a little caustic potash on that spot, and the calf will not wake up from the operation. The horn will not start to grow and the calf will never know what happened, and will have as smooth a head as a muley. Get one shilling's worth of caustic potash and put in a bottle with just enough water to dissolve it, and put in a glass stopper, and when you want to use some, take a pinewood stick like a lead pencil and stick it into the fluid and rub on the little button, and the next day if there is a little dent there the horn is dead; if not put on a little more, but not too much as the fluid runs down. It will take the hair off where it goes. The common box lye will do the work, but don't put on so much that it runs down the head. By all means keep the horns off. The cow has no more need to carry horns nowadays than a man has need of carrying a revolver in company or society."

MISCELLANEOUS.

THE CEYLON AGRICULTURAL SOCIETY.

The address delivered by H. E. the Governor at the Ceylon Agricultural Society meeting on Monday might appropriately enough have been preceded by the singing of Cowper's hymn, one line of which runs "Ye fearful saints fresh courage take." The address was stimulating and encouraging, and just the right stamp of address to give the Society the right send-off for the New Year. We do not propose to criticise the address exhaustively. We hope our readers will make a point of diligently perusing it for themselves, and keep it for reference against the evil days of pessimism and doubt. The Society has settled itself on a solid foundation. It has taken firm root in the somewhat loose and shifting soil of this Island. That in itself is something to have accomplished. Any new idea, especially if supported by H. E. the Governor, may always rely on being received with boundless enthusiasm. That enthusiasm, however, is mostly of the effervescent order. The old experienced Civil Servant does not take kindly to new suggestions. The support which he is prepared to accord to them is of a pronounced non-committal sort. He likes to leave a loophole, so that when the days of adversity come he may apply this flattering unction to his soul: "Well, I told you so, but you would go on." A Governor who can carry his Civil Service with him, get them to emulate his enthusiasm, and see things with his eyes is no ordinary mortal. Then there are the people of the country—the people who are to be more directly benefited. There is first the wealthier and secondly the great masses of peasant cultivators, the gentlemen we speak of when we wish to be thought profound as the *goiyas*. The mood of the former class is a very changeable one, while the latter are popularly represented especially by the principal Revenue Officers of the Island as steeped in an impenetrable conservatism and inoculated with the deadly virus of stagnation and paralysis, firm believers in the comfortable doctrine that what was good enough for their fathers is good enough for them, and as inveterate stickers in the ancestral groove.

The first difficulty then of sustaining enthusiasm in a movement possessing such wide-spreading ramifications has been successfully overcome, and for that the chief credit must be given to H. E. the Governor and upon the happy choice he made of Mr. E. B. Denham as Secretary. The Ceylon Agricultural Society is still, to use an expressive vulgarism, "going strong." Its influence has not yet reached the mass of the population, but it is beginning to, and nothing was more significant at Monday's meeting than the prominence given to Mudaliyar Wickremeratne's paper. But a Society which can boast of 1,000 members in the first fifteen months of its existence, and point to the fact that forty-one local Societies have sprung into being, and have been glad to be affiliated to the Parent Society cannot be described as being in a languishing condition. On the contrary, it is in sound and vigorous health, and is just entering on a new lease of life, promising greater activities and greater benefits in the future. One of the greatest achievements during the year was the acquisition of the "Tropical Agriculturist," and one of the most striking benefits that will be witnessed during the coming year will be the improvement and greater interest witnessed in the various Agricultural Shows which will be held under the Society's auspices. We congratulate all concerned on the very promising outlook, and hope that when another year has passed we shall be able to report that the masses have been awakened, and that they are as keen about improving their methods of agriculture as they were formerly indifferent, and that an era of general agricultural prosperity especially affecting the poorest cultivator has been inaugurated as a result of the missionary efforts of the Ceylon Agricultural Society.—*Ceylon Independent.*

CEYLON AGRICULTURE: PAST AND PRESENT.

The latter days have, in many respects, been of much importance to Ceylon, whose people have revelled in excitement in various directions. Amongst other things, agricultural matters have been prominently to the fore. Seeing that the Island is naturally an agricultural one, that is not surprising; for matters which directly or indirectly affect what must be considered as our predominating interests, have a special claim to the consideration of the public, and so command attention. The inauguration, through the instrumentality of the present Governor—with whom the idea is believed to have originated—of the "Ceylon Agricultural Society" will stand out as a special feature in the annals of last year, and with it His Excellency's name will be perpetually identified. Everyone will admit that it was a move in the right direction. For reasons which it is needless to specify, the Society has been successfully launched; has branches in all parts of Ceylon, with a large and increasing roll of members; is extending its beneficent operations in all directions; and may be expected to exert an influence as powerful as welcome. It has already excited much enthusiasm, and may, in the near future, be expected to have a renovating effect at all points of the compass. Being primarily designed to reach and benefit the more impoverished sections of our husbandmen in a practicable form, advantage will be readily taken of the opportunity presented; and steady general improvement can hardly fail to come about. It would, of course, be the height of absurdity to expect too much in the early days of its career. It is a novel enterprise, and must be allowed to gradually "feel its way." Perfection is unattainable; but continued progress in that direction is always possible. Faults and flaws, as they manifest themselves, will be as far as possible removed. and the ultimate outcome gives promise of being productive of an almost incalculable amount of good. especially to those cultivators who are known to have been for a long time in desperate straits.

The planting community. mainly composed of Europeans, is chiefly interested in the growth of tea, coffee, &c.. for exportation. Their theatre of operations was, until recent times, confined to the hill country, which hap been denuded of its primeval forests and parceled ont into thriving coffee estates. All other vegetation was tabooed, and—until the end of the seventies—Coffee was King! But the inevitable exhaustion of the soil was apparent early in the eighties, and a conviction soon established itself that coffee was doomed, and its days numbered. The doleful story need not be related, for it must yet be fresh in the memories of many with sad experiences of those trying times. Attention had to be diverted to possible vegetation such as was calculated to supplant that which was slowly, but surely, approaching extinction. The experimental introduction of such plants as Liberian coffee, cinchona, cocoa, and tea, was assiduously resorted to; and with success. Their propagation was vigorously engaged in by the majority, while a few went in for coconuts, &c. Liberian coffee failed to answer; cinchona made "the mouth water" at the outset, and its cultivation was rapidly extended; but, alas! soon a big "full stop" loomed in the distance. The high prices which the bark at first realized gradually dropped; the price of an ounce bottle of sulphate of quinine fell from 20 rupees to something less than two; the industry ceased to pay; and the plantations were ruthlessly destroyed!

Cocoa was too sensitive—too particular about locality—and would only thrive under very favourable conditions; but where a suitable lodgement was met with, a robust and remunerative estate came into being, with all the elements of permanency; and still flourishes. With tea, things were different. It will grow almost anywhere—a fact demonstrated by the Sinhalese method of expressing

the opinion that certain land was (from a cultivator's point of view) of minimum value: "it will not grow *even tea.*" Generally speaking, tea-planting proved a success; and for a considerable period high prices were obtained. It gradually took the place of coffee, and prosperity reigned. It was, however, not long before unfavourable signs asserted themselves. Prices persistently declined, until a point has been reached which fails to yield the barest margin of profit, and many an estate seems to be "on its last legs." But, as the darkest hour precedes the dawn, so there is hope for the future—a hope which has lately been intensified by the "lucky find" made. Just now people are buoyed up with the potentialities of rubber! A sort of speculative mania has established itself, and brought about an extraordinary "boom" in land, which is being sought after, and acquired, in every promising neighbourhood. The new industry engrosses attention. The "craze" is at its height; and temporarily eclipses everything else. The rush for rubber land has greatly inflated prices. Prospects are bright; for capital will be attracted, while the paying capabilities of the new enterprise are—for some time, at any rate, fully assured. The more distant future is highly enigmatical, and may be put of sight, it being the "living present" which more immediately interests the bulk of mankind.—*Ceylon Standard.*

A TYPICAL LOCAL AGRICULTURAL SOCIETY.

The most interesting and instructive feature of Monday's meeting of the Agricultural Board to our way of thinking was Mudaliyar Wickremeratne's description of the work of arousing interest in agricultural reform among the villagers of Telijjawila in the Weligam Korle. It was an excellent paper, well-expressed and pointed the situation as we imagine it actually exists. It is important as marking the first report of a serious attempt to diffuse the benefits of the Association to the villagers. There is no attempt to underestimate the difficulties in the way. They are great, but we gather from the general tone of the Mudaliyar's paper that he does not regard them as insuperable, neither are they, though the effort to awaken the villagers out of their lethargy may be a slow and laborious one and tend to discourage all but the most earnest and persevering. To those who make the iniquity of headmen their pet theme we would cite the example of the headmen of this Korle under the leadership of their enterprising Mudaliyar. The progress at first was naturally slow, but the promoters seem to have been fully alive to the difficulties which they would have to surmount and persevered with the excellent results described in the paper. We cannot do better than repeat the objects of the association which might well serve as an example and encouragement to other district associations. The objects were "to enable the villagers to add to their necessaries of life by the means already at their disposal, to improve the existing methods of cultivation so as to bring better returns, to extend the cultivation of vegetables and other products that form the daily diet of the villagers to such an extent that every villager will not only have enough stock for his own use, but also something to spare for the market, to encourage the cultivation of fruit trees and introduce new products, and to improve our stock."

Could anything more advantageous to the villagers in this particular Korle have been adopted? No wonder that for a time they were spell-bound at the suddenness of such a change, all the more so as the principal agents for bringing these benefits within the reach of all belonged to the despised class of headmen. There has been no intimidation and no threats. The Society has both in a literal and metaphorical sense had to operate upon virgin soil. Persuasion has been resorted to where persuasion was needed numbers have been reproved for their

idleness, and all have been open to the instruction of the Society and its officers. But for Sir Henry Blake calling the Agricultural Board into existence we should not have had this spectacle of headmen uniting in an earnest attempt to improve the condition of the labouring classes. It tempts one to remark that the people who had got into hopeless grooves were not merely confined to the goiya-class, but that indifference and stagnation had even spread to the highest branches of the Revenue Service. Those who are in the habit of reading administration reports know what a dry and dolorous task that is. Why should not Government Agents and their assistants be encouraged to make their reports more interesting and more "live" by describing the efforts they have made and the experiments they have initiated for bettering the condition of the masses over whom they are placed in charge. For years these revenue officers have gone on on narrow stereotyped lines. Let them take fresh courage and help themselves in the awakening of the masses and earn the gratitude of posterity instead of being content as now to crowd their reports with masses of uninteligible statistics regarding crime, village requirements in the way of roads and bridges, &c.—*Ceylon Independent.*

The Literature of Economic Botany and Agriculture. I.

By J. C. Willis.

Those who are engaged in the answering of questions relating to these topics must often wish that there were some convenient index to the endless books, articles in journals, and other publications dealing with them. With a view to providing some slight help to such persons, and to the large public that is more or less interested in these matters, I have undertaken the publication, at odd times, of the lists of such publications which are kept in my own office. The system there adopted is simple. The office receives almost every journal that contains anything of value relating to tropical agriculture or economic botany. Before being passed to the rack of "Additions to the Library," every single one of these journals is looked through by myself, and the titles of its contained articles are indexed upon a series of sheets of paper, kept in alphabetical order, and each headed with the name of some product. In the case of common products, especially such as are produced by several distinct plants, the common name is used, as tea, cacao, indiarubber, &c., in other cases the scientific generic name is used as Aberia, Acacia, Adansonia. In this way a file is formed, to which I can refer at any time, and find out some at any rate of the numerous articles dealing with the different products.

In giving the following lists, therefore, I wish it to be distinctly understood that they are not necessarily complete, nor do they in general go back further than 1899 or 1900, but for the papers published since that time they at any rate approach to completeness.

Journals dealing with tropical agriculture copy so largely from one another that articles, obviously copied, are not indexed a second time here.

Owing to my absence on leave in 1902-3 and my accident of last year, the publications of those periods are not quite fully indexed.

It is especially hoped that these lists may add (in a sense) to the Library Catalogue at Peradeniya, and enable the visitor to make the best use of the library.

Aberia.—The kei apple (*A. caffra*, Hook.). Queensland Agr. Jl., June, 1899, p. 468.
Acacia.—Notizblatt k. Bot. Gtns. Berlin, II, 1898, p. 176.
Commercial uses of Indian Acacias. "*T. A.*" Nov. 1903, p. 303.
Culture des Acacies et leur production en tanin. Revue des Cult. Col. Juin 1904, p. 331.
Wattle Bark. "*T. A.*" Suppl., June, 1904, p. 863.

Adansonia.—Etude sur la graine du Baobab. Bull. Jard. Col. Mai, 1904, p. 658.

Agave (and cf. Sisal Hemp). Pulque. Tropenpflanzer, July, 1899, p. 337.
The Agaves of Mexico; their varieties and economic uses. Indian Gard. and Planting, Sept., 1901, p. 254.
Agave americana &c. Journ. d'Agr. Trop. 1, p. 105.
Etude sur le Maguey de Tequila. Rev. d. Cult. Col. 1902, p. 294.
Agave fibre as a catch crop to tea. Ind. Agriculturist, Sept., 1904, p. 280.
Agave fibres. Ind. Plant. and Gard., Nov. 1904, p. 807, Dec. p. 843.

Aleurites.—Le Bancoulier. Rev. d. Cult. Col. 1900, p. 443.

Allspice.—Hanausek: Zur Falschung der Pimento. Beih. z. Bot. Centralblatt, VIII. 1899, p. 469.
Allspice. cf. ditto, p. 470.

Alstonia.—Straits Bulletin, 1903, p. 114.

Andropogon (and cf. Citronella, Lemongrass). Andropogon oils. "*T. A.*" Oct., 1903, p. 283.

Angophora.—Fawcett; Timber Trees of Queensland. Q. Agr. Jl., 1900, p. 313.

Annatto.—Peckolt, cf. Just's Jahresbericht, 27, 1899, II, p. 50.
Annatto Dye. Agr. Ledger, Veg. Prod. Series, No. 87, 1904.

Aquilaria.—Aquilaria Agallocha. do. No. 78, 1904.

Aramina.—L'Aramina. Rev. d. Cult. Col. Jan., 1902, p. 49.

Araucaria.—Sur l'*Araucaria Rulei* F. v. M......sa gomme résine. Rev. d. Cult. Col. 1901, p. 289.

Areca.—Cultivation of Areca in the Godavari district. "*T. A.*" Apr., 1899, 676.
Cultivation of betelnut palm in the Bombay Presidency. Agr. Ledger, Agr. Series 30, 1900.
Les maladies de l'arequier en Cochin-Chine. Bull. Econ. de l'Indo-Ch. 1900, p. 541.
A plague in the betelnut palm. Agr. Ledger, Disease Series No. 6.
The Areca palm. Ind. Agriculturist, Aug., 1904, p. 232.

Backhousia.—Lemon-scented Myrtle. Queensl. Agr. Jl. Jan. 1900, p. 49.
Backhousia myrtifolia. do. Feb. 1900, p. 126.

Balata.—Balata-produktion in Venezuela. Tropenpflanzer, 1901, p. 285.
Growth of Balata Production. "*T. A.*" Nov. 1901, p. 295.
Le Balata. Jurn. d'agr. trop. I, 150, 1901.
Balata seeds. Trinidad Bull., Jan. 1902, p. 415.
Les Balatas de la Guiane francaise. Bull. Jard. Col. Mai., 1904, p. 747.

Balsam of Peru.—Preuss; der Perubalsam in Central Amerika und seine Kultur. Tropenpflanzer, 1900, p. 527.
Mannich; Chemische Untersuchung der Perubalsamsorten, do. p. 543.
Balsam of Peru. Chem. and Drug., Apr. 1901, p. 638.

Bamboo.—Bamboo Manna. Nature, June, 1900, p. 127.
Bamboo Manna. Agr. Ledger, Veg. Prod. Series, No. 63.
Le Bambou epineux. Rev. d. Cult. Col. 1901, p. 227.
Note sur le multiplication des bambous. Bull. Jard. Col. Juli, 1904, p. 122.
L'industrie des chapeaux de bambou a Java. Bull. Econ. de l'Indo Ch., 8, p. 881.
Conserves de pouses de Bambou. do 1055.

Bassia.—La preparation et la commerce du beurre de Karite (B. Parkii). Rev. d. Cult. Col., Nov. 1899, p. 304.
The commercial value of Mhowra seeds (*B. latifolia*). Indian Forester, 1903, p. 543.
Bassia latifolia and longifolia. "*T. A.*" July, 1904, Suppl. p. 63.
Bassia latifolia. Ind. Forester, XXX, Oct. 1904, p. 165.

Blighia.—Oil of Akee. Jamaica Bull. 1901, p. 74.
Sur un Sapindacée a arille comestible. Rev. d. Cult. Col. 1901, p. 193.

Bosqueia.—Note sur le Sekegna ou Saccagna, *B. angolensis* (Welw.) Fic. Rev. d. Cult. Col. 1901, p. 297.

Breadfruit.—The breadfruit. Queensl. Agr. Jl., Apr. 1898, p. 299.
The Breadfruit. Baum in Jamaica Bull., 1904, p. 141.
Starch from Breadfruit. Imp. Bull., March, 1904, p. 28.
Bread nut (seeded variety). Agric. News, III. 1904, p. 263.
Breadfruit meal. Agr. News, Dec. 1904, p. 404.

Broom Millet.—Broom Millet. N. S. Wales Agr. Jl., 1901, p. 559.
Brooms and Broom Corn. Agr. News, 1903, p. 142.

Brucea.—Sur la graine de Ko-sam, *B. sumatrana*, Roxb. Heckel in Rev. d. Cult. Col. Fev. 1900, p. 97, &c.
Contributions a la bibliographie de *B. antidysenterica*, do. 434.
Brucea sumatrana. Straits Bull. I, 1902, p. 342.
Brucea sumatrana. do. II, Feb. 1903, p. 41.
Chemical Examination of Ko-sam seeds. Chem. and Drug., Aug. 1903, p. 234.

Butyrospermum.—Quelques notes sur le *B. Parkii* Kotschy. Rev. d. Cult. Col. Juil 1901, p. 72.
Winke zur Verbreitung der in Togo haufigen, *B. Parkii*, Kotsch Notizbl. d. k. Bot. Gtns. Berlin. Dec. 1904, p. 166.

The Ceylon Board of Agriculture

The Fifteenth Meeting of the Board of Agriculture was held on Monday, January 8th, 1906, at 12 noon, at the Council Chamber.

His Excellency the Governor presided.

There were also present:—Sir Alex. Ashmore, Lieut.-Governor, The Hon'ble Messrs. G. M. Fowler, C.M.G., H. C. Nicolle, H. Wace, C.M.G., H. L. Crawford, F. C. Loos, S. C. Obeyesekere, S. N. W. Hulugalle Dissawe, and John Ferguson, C.M.G., Drs. J. C. Willis, A. Willey and H. M. Fernando, The Maha Mudaliyar, Messrs. E. E. Green, M. Kelway Bamber, H. T. S. Ward, J. Harward, G. W. Sturgess, W. D. Gibbon, Solomon Seneviratne, Atapattu Mudaliyar, Francis Beven, C Drieberg, and E. B. Denham, Secretary.

As Visitors:—Messrs. E. Cowan, D. Obeyesekere and J. A. Wickremeratne, Mudaliyar.

BUSINESS DONE.

1. The minutes of the previous meeting were read and confirmed.
2. List of new members for election was read.
3. Progress Report No. XIV. was circulated.

4. His Excellency the Governor then delivered an address on the work done by the Society during the past year—(*vide* pages No. i to iv, in this month's Magazine.)

5. Mr. H. T. S. Ward moved "That this Board recommends that a tobacco expert be employed by the Society for the improvement of the tobacco now grown in Ceylon." Mr. Obeyesekere seconded. H. E. the Governor, Dr. Willis, Messrs. Ferguson, W. D. Gibbon, Wace, Lushington and Beven spoke on the subject. The motion was carried.

6. Mr. J. A. Wickremeratne, Mudaliyar of Weligam Korale, and Hon. Secretary Local Branch of the Society at Telijjawila, read a paper on "The Work of a Local Agricultural Society." His Excellency and Mr. Gibbon spoke.

7. It was decided to postpone the paper by Dr. Willis and the other subjects on the minute paper for the next meeting.

The Board adjourned at 1-30 p.m.

Agricultural Society Progress Report. XV.

The number of members of the Society is now 1,001. showing an increase of 67 since the last meeting.

A proposal is now before the Finance Committee to allow of the election of Life Members of the Society.

Local Societies.—Since the last meeting of the Board I have visited the Branch Societies at Katana, Katunayaka, Minuwangoda, Kandy, Anuradhapura. and Ruanwella (Three Korales and Lower Bulatgama).

At *Katana* a piece of ground has been rented for an Experimental Garden and a caretaker employed.

A prize of Rs. 100 was offered by Mr. S. M. Silva for the best work done in the garden by a child from any of the local schools. A small plot of ground is to be given to each child competing. It was decided to limit the prize to Rs. 20, the balance to be expended on other prizes to be decided upon by the Branch Society.

At *Katunayaka* an excellent Experimental Garden has been opened by Mr. A. E. Rajapakse, Muhandiram, the President of the Branch. Forty villagers undertook to plant up vegetable gardens, and Mr. Rajapakse offered four prizes of Rs. 15, Rs. 10, and two of Rs. 5 for the best results.

At *Minuwangoda* nothing practical had been done. The meeting held by me was attended by 500 or 600 persons. It was decided to award prizes for the best exhibits of vegetables grown in the district shown on the 1st Saturday in April at the Coronation Market at Minuwangoda. Prizes to the amount of Rs. 105, in twenty-rupee (two prizes), ten-rupee and five-rupee prizes, were offered for the best exhibits of vegetables (grown in the district and grown for the first time in the district), for fruits, yams, ground nuts, silk cocoons, and *mi-kiri.*

A number of villagers gave in their names as competitors. It is to be hoped that the interest now aroused and the exertions of Mr. J. E. de Silva, President, Village Tribunal, will result in practical work being attempted by this Branch.

The *Anuradhapura Branch* will offer a prize for the best lot of cotton grown in the district sent in to Maha Iluppalama by a villager. It has been decided to purchase all cotton grown by villagers at a fixed price at the Maha Iluppalama Experiment Station, cash being paid on delivery.

At the meeting of the *Three Korales Branch* held at *Ruanwella* prizes to the amount of Rs. 105 (nine prizes of Rs. 10 each and three of Rs. 5 each) were offered for the best exhibits of plantains, collections of vegetables, cucumbers, yams,

chillies, pineapples, brinjals, manioc, bandakkai, and ground nuts, and for the best village cock and two hens to be exhibited on the first Sunday in August at the Yatiyantota Market. Application is being made for the use of a piece of Crown land for an Experimental Garden.

Castration demonstrations were arranged for at these meetings.

The Committee of the *Kandy Branch* decided to hold a general meeting on the 26th instant.

Several papers have been read at meetings of Branch Societies. At Jaffna a paper on "Manioc Cultivation" was read by Mr. J. P. Lewis, Government Agent a paper on "Tobacco" was read at the meeting of the Kurunegala Branch by Mr. Madapola; "Poultry" was the subject of a paper read by Mr. E. D. Dharmasena at the meeting of the Badulla Branch. A paper on "Sweet Potatoes," by Mr. A. M. Wickremeratne, is promised the Wellaboda pattu (Galle) Branch.

Agricultural Shows.—The following dates have been approved by the Society:—

Weligam Korale (Telijjawila) Branch	March 15 and 16
Gampola	March 30 and 31
Nuwara Eliya	April 17 and 18
Kurunegala	May 14 and 15
Badulla	May
Colombo	June 22 and 23
Kegalla	July 6 and 7
Avisawella	September

No dates have yet been fixed for the Matale Show.

The Rubber Exhibition has been fixed for 13th, 14th, and 15th September.

The two portable iron sheds have now been completed and despatched to Weligama for use at the Weligam Korale Show.

Experimental Gardens.—Arrangements are now being made for the erection of a seed depôt at the Government Stock Gardens. An estimate of Rs. 1,000 for the erection and fitting out of building will be laid before the Board. The expenditure of Rs. 100 on purchase of seed for the Society has been sanctioned.

Mr. Francis L. Daniel has offered the Society for experimental cultivation by any member about 10 acres of land at Madampitiya suitable for paddy cultivation.

The statement in the last Progress Report that the Weligam Market land had been planted with fruit trees and vegetables was based on a misunderstanding, as was at once pointed out by the Weligam Korale Mudaliyar. The fruit trees have been procured from Peradeniya, but, on the advice of Mr. Macmillan, it was decided to postpone planting until after the south-west monsoon.

Paddy.—The following letter has been received from the United States Department of Agriculture:—

We are very sorry to be obliged to report that the seed rice, three hundred bushels of which we were getting for you, is of such poor quality that we do not dare to take the responsibility of forwarding it to you at your cost. We will shortly send you samples of the best Carolina rice procurable this season, and you will see that it is of poor quality and would be disappointing to you in your trials with it. We are of course ready to make another trial next year, when it is to be hoped the rice crop will be good. We are very sorry to disappoint you in this matter, but I think you will be grateful to us for saving you what will be an unnecessary expense and would unquestionably disappoint you in the end. Trusting you will call upon us next year, if we can be of assistance to you,

I remain, &c.,

DAVID FAIRCHILD,

December 16, 1905. *Agricultural Explorer in Charge of Foreign Explorations.*

It is unfortunate that the Carolina seed paddy cannot now be procured. It appears that a supply formerly imported is now grown as a hill paddy in the Wellassa district of the Province of Uva, and is a much-prized variety in the villages cultivating it. The Madras authorities have booked the Society's order for the "sixty-days" seed paddy.

The Telijjawila Local Society will distribute seed paddy to the poorer villagers on the 20th instant at a nominal interest of 5 per cent.

Cotton.—Sea Island, Egyptian, and Uplands cotton seed is now sent free from Maha Iluppalama to members of the Agricultural Society. The cost of transport only will have to be borne by members desiring to try this cultivation.

Two cotton gins—a Patent Hand-power MacCarthy Cotton Gin and a Hand Saw Gin—have been received from the British Cotton Growing Association. Applications for the loan of these gins should be made to the Secretary.

Ground Nuts.—Distributions of nuts for seed have been made by many members of Local Societies. Mudaliyar J. V. G. Jayawardene of Kalutara Totamune has distributed 55 bushels. Mr. A. Mailvaganam of Koppay, Jaffna, reports a yield of 150 lb. on 2½ lb. sown, and states that he will now cultivate on an extensive scale.

Papaw Juice.—The development of the industry has attracted attention, and Mr. C. Drieberg is preparing a sample of papaw juice for a trial shipment to England.

Offer of a Prize.—Dr. P. M. Muttukumaru has offered a prize of Rs. 50 for the *best invention of an appliance for tethering cattle* in such a way that they will not damage young coconut and other plants.

Manures.—Messrs. Freudenberg & Co. have informed the Society that they are prepared to place suitable fertilizers for coconuts, tobacco, cotton, &c., at the disposal of the Agricultural Society for small experiments at various stations to be carried out by responsible parties. The Society will assist such experiments by forwarding these fertilizers free. Local Societies are being informed of Messrs. Freudenberg's offer.

Government Dairy.—The Live Stock Committee have recommended the removal of the Government Dairy from Colombo, and that experiments be at once made in sterilization of milk.

Notice of a motion for the next meeting of the Board will be given at to-day's meeting.

Sericulture.—Mr. A. Perera, Assistant Inspector of School Gardens, is now making a tour in the Central and North-Western Provinces purchasing cocoons at Re. 1·50 a lb. cash payments. He has already sent in 55 lb. of cocoons to the Government Entomologist. The attention of members is invited to the new leaflet on Sericulture, No. XVI.; leaflet No. IX. is cancelled. Samples of cocoons are being sent to Bangalore and Manchester.

Castration.—The Government Veterinary Surgeon reports that demonstrations have been applied for and arrangements made for holding them at Veyangoda, Panadure, and Negombo in the Western Province; Mannar and Delft in the Northern Province; fifteen centres in the North-Western Province; thirteen centres in the North-Central Province; eight in the Kandy and two in the Nuwara Eliya Districts.

At Delft 101 cattle have been already operated upon and nine men trained. It should be noted by Local Societies and Village Committees that at the same time as castration demonstrations are being given, a selection of the best bulls for breeding should be made. Applications should be made as early as possible, and sufficiently long notice given for the convenience of the Veterinary Department

and to allow of as many animals as possible being produced at the demonstration centres. Many of the Local Societies and Village Committees are now supplying the trained men with instruments. The locally trained men in the Weligam korale have operated on thirty-three animals.

Publications.—Leaflets on "Shade Trees" and "Agricultural Shows—Instructions for Forwarding and Arranging Exhibits" in English and the vernaculars are with the Printer.

The Editors of the "Sihala Samaya" and the "Dinakaraprakasa" kindly forwarded 100 copies of two editions of their papers containing in Sinhalese the proceedings of the last Board meeting, for distribution among the Local Societies.

The first number of the Tamil edition of the Society's Magazine, entitled "Kamat Tholil Velakkam," appeared last month. The Editor, Mr. J. P. Cooke, of the "Morning Star," Jaffna, deserves the thanks of the Society for his enterprise and success in bringing out this edition, the first number of which promises well. A copy is laid on the table.

E. B. DENHAM,

February 12, 1906. *Secretary, Ceylon Agricultural Society.*